FIRST
REPORT

FROM THE

SELECT COMMITTEE

On the State of Disease, and Condition of the Labouring Poor, in Ireland.

Ordered, by The House of Commons, *to be Printed,*
17 *May* 1819.

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REPORT.

THE SELECT COMMITTEE appointed to inquire into the State of *Ireland*, as to Disease, and how far the Measures, remedial and preventive, adopted by the Legislature or otherwise during the last year, have been effective for its removal or mitigation; and also into the Condition of the Labouring Poor of that part of the United Kingdom, with a view to facilitate the application of the Funds of private Individuals and Associations, for their Employment in useful and productive Labour; and to report their Observations, together with their Opinion on these Subjects, from time to time to The House;—HAVE, pursuant to the Order of The House, examined the matters to them referred, and have agreed to the following REPORT:

YOUR Committee have, in compliance with the order of reference, directed their attention, in the first place, to the examination of the actual state of Ireland as to Disease, and the effect of the Legislative provisions humanely enacted in the last Session of Parliament, for the removal or mitigation of that public calamity. They now proceed, under the power intrusted to them of reporting from time to time their opinion thereon, to state to the House the result of their inquiries into this the earliest, although perhaps not the most essential or most difficult object of their investigation.

The labours of Your Committee as to this branch of their inquiry, have been materially abridged and facilitated by the judicious measures adopted by the Irish government, for ascertaining, by accurate inspection, the actual state of those districts of the several provinces where this epidemic fever had most fatally prevailed; and they have been enabled, by the detailed reports of the respectable and intelligent members of the medical profession selected to perform this humane and valuable duty, to lay before the House more satisfactory information on this interesting subject than would probably have been attainable from any other sources. The liberality of the public had, in compliance with the recommendation of the Committee of the last Session been continued and increased, in aid of the voluntary contributions for relief of the diseased, and it was on every account most desirable that the Irish government who had thus dispensed the public bounty should be enabled to ascertain the effects, produced by the expenditure of the public and private funds for attainment of this great object under the provisions adopted by the legislature.

Your Committee therefore, have annexed these Returns of the medical Inspectors as an Appendix to this Report; which, with the tables accompanying them, will, they are confident, receive from the House that serious and considerate attention, which such documents so well deserve; and they venture to add that without a careful perusal of them, a very inadequate opinion will be formed of the extent of the calamitous pressure on the body of the people, and the great sacrifices and meritorious exertions of the residents of all classes for relief of the diseased. The reports on the provinces of Munster and Leinster, and particularly the cities of Dublin, Cork, Waterford, and Limerick, where the disease prevailed most extensively, and where the more general establishment of fever hospitals has afforded the means of more correct information, appear best suited to elucidate this interesting subject of inquiry.

The Committee consider the Act of last Session as only in the commencement of its operation, and cannot feel any surprize if a course of legislative regulations, in some parts novel, and enacted under circumstances of severe and calamitous visitation, has in some instances, and especially where imperfectly acted upon, failed to produce an immediate effect, or should have been sometimes misconceived, as to its tendency and the nature of its provisions: in this latter observation they particularly refer to the enactments respecting the establishment of a Board of Health, which, though guarded most scrupulously against any possible abuse of those great powers which could alone be efficacious in such extensive cases as it was calculated to meet, appear to have excited, in some parts, unmerited distrust and jealousy; whilst they have been acted upon in other places, Newry in particular, where they are stated to have produced the most salutary results.

Your Committee however consider themselves warranted in expressing a sincere and satisfactory conviction that the Act has been signally and powerfully effective in the attainment of its objects through many extensive districts of a country severely afflicted with disease: The remedial means pointed out by the Act, where fully adopted, have worked extensive good; and as they trust they will be still more powerfully efficacious as they are more generally acted on Your Committee considers itself in a great degree released from further immediate consideration of that branch of the subject.

The Reports of all the Inspectors, and accurate information derived from other most respectable individuals concur in the necessity of looking to the establishment of measures for the prevention of disease, and to securing the people of Ireland against its recurrence and increase, by assiduous and regular attention to cleanliness of the streets of the cities and

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and great towns, and ventilation and purification of the dwellings of the Inhabitants.

In this view Your Committee consider it of infinite moment that the necessity of local systematic and unpaid control should be impressed on the Inhabitants of all cities and great towns, where the assemblage of large bodies of people creates those nuisances which generate and increase disease; and have therefore sought out the means of calling into action parochial assistance in performance of those duties, as best suited to the object; being well satisfied, that appointments of that nature induce the most salutary and efficacious results of individual and collective exertion: in no case can we look to this exertion with more confidence, than when the health and comforts of the community are in question; nor at any time, than when that community having severely felt, and still continuing to feel, though in a lesser degree, the fatal consequences of past negligence, or the want of such provision, by the visitation of disease, will be disposed duly to estimate the value of such a regularly acting and established system. Under such circumstances, Your Committee venture, with some degree of confidence, to recommend certain Legislative Regulations, directed to this important object.

They have also adopted, but with some doubt as to its efficacious practical results, a suggestion, intended to prevent the migration through the country of numerous bodies of mendicant poor, who, pressed by distress and seeking for relief have fatally contributed to the general diffusion of disease. For this evil, to which the concurring medical Reports of the last and present year mainly attribute the extension or the disorder, it is most difficult to devise a remedy, which will not lead, in its consequences, to the establishment of a system of Poor Laws, that, in a country like Ireland, would produce incalculable evils to every class of the community.

The measure which Your Committee proposes, merely goes to confirm powers in the Magistracy which formerly existed, and to extend them to some other officers; but to render the pecuniary provision for the expenses incurred in their execution entirely dependent on the voluntary Contributions of Individuals, or local Public Communities.

Your Committee now proceed to lay before the House in detail, the Regulations, which they feel it their duty to recommend for the purposes aforesaid.

1. That in order to provide for and secure constant and adequate attention to the health and comforts of the Inhabitants of Ireland, and the prevention of contagious disease, more especially in the cities and great towns thereof, it appears requisite, that Officers should be annually elected by the Householders in all cities and great towns, containing above one thousand Inhabitants, and in such of the Parishes of the country as may think proper to adopt a similar measure; which officers shall be, during the year of their continuance in office, intrusted with full powers to direct all streets and lanes, and yards adjoining thereto, and houses let in several tenements to room-keepers, and the

yards connected therewith, to be cleansed, and all nuisances prejudicial to health to be removed therefrom, and to clear public sewers, and cover them where necessary, and to fill up or drain off all lodgments of standing water, and to cause to be done such works for ventilation and fumigation and cleansing of any house in which fever has occurred, and the washing and purifying the persons and clothes of its Inhabitants, as shall appear to them indispensably necessary for the preservation and security of the inhabitants of the parish; and that in all cities and great towns, as above mentioned, where the inhabitant householders shall neglect or omit to make such appointments for one month after the 25th of March in every year, it shall be competent for the Magistrates assembled in Quarter Sessions to make such appointment; and that all constables and other peace officers be empowered and required to be assistant to the said Officers of Health, when called upon in execution of their duty.

2. That such Officers of Health should be chosen in vestries parochially in all cities and great towns, and also in such country parishes as shall think it proper to adopt this measure, to the number of not less than two, or more than five for each parish, and shall act without salary; and that the expenses incurred in discharge of their duties enjoined by these Resolutions, the amount whereof shall not exceed such sum as the inhabitant householders shall, at the appointment of such officers, limit and direct, be levied by parish rate in such manner and form as the other parochial assessments are; and the expenditure accounted for in a similar manner; but at such periods of the year, and as often as the parochial meeting shall direct, by the said Officers of Health; and that copies of such accounts be transmitted annually to such public office or officer in Dublin as the Lord Lieutenant shall direct.

3. That in all cities and towns as aforesaid, where the sweeping of the streets and dung collected there is not already vested, or by any Act shall be vested in the corporate body, or where the scavengers or other persons intrustsd by such corporate body with the care thereof, shall neglect or omit to exercise the powers intrusted to them, by cleansing the streets and lanes twice in every week at the least, after notice given of such neglect or omission by any inhabitant to the scavengers or other persons so intrusted, the dung and sweepings of the streets may and shall, in 24 hours after, be collected and sold by the said Officers of Health for the benefit of such parish, and accounted for in diminution of the charge incurred in execution of their several powers.

4. That any magistrate or churchwarden, or any of the officers so to be appointed, be empowered to remove out of their respective parishes any persons who shall be found begging or wandering as vagabonds therein, or to confine such persons to hard labour for 24 hours in any bridewell, or other public place of confinement, or to adopt both measures, as the case may require; and to cause the persons and clothes of such vagabond beggars to be washed and cleansed during the period of their confinement; and that the magistrates assembled at any quarter sessions, or adjournment thereof, be empowered to constitute any suitable unoccupied

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occupied building to be a bridewell for the said purposes; provided that it be so appropriated and continued with the consent of the owner or proprietor thereof; and that it be earnestly recommended, that wherever public buildings exist, which are no longer necessary to be applied to the original object of their destination, they may be allowed to be used for the purposes aforesaid.

Your Committee having thus submitted their general view of this branch of the subject intrusted to them, and embodied the results in the foregoing Regulations, are proceeding, in farther execution of their duty, to inquire how far it may be practicable to ameliorate the condition of the Labouring Poor, by facilitating the application of the Funds of private individuals and associations, for their employment in useful and productive labour; by which alone Your Committee feel themselves warranted to expect the entire and permanent removal of a malady, which, although much mitigated in its severity, and more circumscribed in its extent, still continues to press heavily on the community, and which the united testimonies of every competent inquirer attribute to the want of employment of the labouring classes, as a primary and powerfully efficient cause.

17 *May* 1819.

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APPENDIX.

— I. —

A REPORT ON THE STATE OF FEVER IN THE PROVINCE OF MUNSTER.

THE insertion of the following letter, received from Mr. Secretary *Grant* on the 13th of February last, appears to me requisite to explain the objects of my mission, and the means which I have adopted to fulfil its several duties.

Dublin Castle, 12th February 1819.

HIS Excellency the Lord Lieutenant having been pleased to appoint Doctor Francis Barker, as a temporary medical inspector for the province of Munster, for the purpose of ascertaining, by inquiry to be made by him on the spot, the exact state of Fever throughout the province, with the view of submitting in detail for His Excellency's consideration, such medical or preventive measures, (in addition to those now employed,) as might in his judgment prove the means, not only of relieving the persons afflicted with contagious fever, but of checking its further progress in their several dwellings; I have to communicate His Excellency's anxious desire and confident expectation, that magistrates of every class, the clergy of all persuasions, and the several respectable persons who superintend and execute the arduous and useful duties of governors and medical attendants on the fever hospitals and dispensaries which have been established throughout the province of Munster, will be pleased to afford their best advice and assistance to Doctor Barker, for the purpose of enabling him to discharge the important trust committed into his hands, with benefit to the country at large.

(Signed) *Charles Grant.*

HAVING received the commands of His Excellency the Lord Lieutenant, to act as a temporary medical inspector for the province of Munster, I proceeded, conformably with my instructions, to ascertain by inquiry made on the spot, the exact state of fever throughout five counties of that province; and I now submit for His Excellency's consideration the several results of my inspection, together with such medical and preventive measures, (in addition to those now employed), as may in my judgment prove the means, not only of relieving the persons afflicted with contagious fever, but of checking its further progress in their several dwellings.

To discharge this important trust, I addressed myself to those gentlemen who, from official situation as magistrates or clergymen, or from connection with various fever hospitals or dispensaries, were likely to afford accurate and satisfactory information; and the substance of the following Report has been framed from a comparison of the separate statements of numerous individuals in the same or in different parts of the province; from visits to the different establishments receiving patients in fever, and in almost every instance from personal communications, carefully noted down at the time. The several inspectors employed on this occasion, had judged it expedient, previous to their setting out on their mission, to decide upon and methodize the different subjects connected with this inquiry. These have been arranged under the following heads, in the form of Queries, and in the order which I propose to observe in this report.

1.—Has Fever prevailed in . . . . . does it now prevail; and is it increasing, stationary, or decreasing?

2.—Is there any district in this neighbourhood where it has not prevailed, or any class of people among whom it has not showed itself; and if so, what peculiarities in their habits or modes of living have been observed.

3.—When did this epidemic fever first appear? at what time was it most prevalent and fatal; and what proportion does the number of those who have been attacked, bear to the whole population?

4.—Were any remarkable circumstances observable in the state of the people in this place, when fever first made its appearance among them?

5.—Does it differ from the ordinary fever of this country, and has any change in its character taken place; and if so, at what time?

6.—What means have been employed to counteract it, and with what success? are there any districts in this neighbourhood unprovided with medical aid?

7.—Were relapses frequent; and if so, during what times since the commencement of the epidemic? did the disease often recur in the same individual at distant periods; and if so, from what causes.

8.—What effects did it produce on the constitutions of the sufferers?

9.—Has it extended through families; or from the sick, to the medical or other visitors or attendants.

10.—Can accurate returns, in periods of twelve or six months, or monthly, of the numbers admitted, cured, and died in hospitals, or of those who sickened and passed through the disease in their own houses, be supplied?

THE Facts resulting from Answers given to the preceding Questions, together with such collateral information as appeared to be connected with the subject, are stated for the different counties in this order:—Waterford, Cork, Kerry, Limerick, and Tipperary; and this division has been adopted because the soil and situation of the different counties, and the habits and circumstances of their inhabitants are so distinct, that such varieties of the epidemic fever might be expected to exist, as would, on comparison, afford information as to the progress of disease, and the means best adapted for its prevention.

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County of Waterford.

County of Waterford.

IN the county of Waterford, various places were inspected, particularly those where fever had been most prevalent, including Waterford, Dungarvan, Cappoquin, Lismore, Tallow; where, from the establishment of fever hospitals, most information was likely to be obtained. Various particulars were also learned as to the state of fever in Kilmacthomas, Tramore, and other small towns situated on the adjacent sea coast.

1.—In Waterford, fever had for some time prevailed in a very considerable degree, and at the period of my visit seemed to be increasing; but this apparent increase was attributed by most well informed persons to an active inspection of the city, lately instituted by the medical gentlemen, with other benevolent individuals, and consequent reception into the hospital of many patients in fever, who but for the visits of the inspectors, would have remained in their own dwellings.

The hospital was crowded in an extreme degree; and it had been just resolved to extend the accommodation, and to appropriate some of the wards in the contiguous city hospital to the reception of fever patients. The great prevalence of fever at this period will become evident on inspecting the return No. 1. from which it will appear that the number of patients in hospital on the 20th of last February exceeded more than four times the number at the latter part of 1817. It is satisfactory to state, from information lately received, that the disease has now considerably decreased in Waterford, and that the patients admitted to the hospital during the last week of March did not in number much exceed one-third of those admitted during the same period, at the commencement of last January.

2.—In some of the smaller towns contiguous to Waterford, fever had also prevailed, but as I was credibly informed, it was on the decline; and in Tramore and its vicinity, which had also been visited by this malady, there was not a single case of fever at that time.

This epidemic fever seemed to have first showed itself at Passage, a small seaport town near to the mouth of the river Suir, about the end of the year 1816, or the beginning of 1817. In the month of February of the latter year, it was very prevalent in that town; and little doubt can exist of its prevalence in this quarter, and at Waterford, before it made its appearance in more inland places situated to the west of this city.

From the reports of fourteen medical gentlemen, and other well informed persons, it was satisfactorily proved that fever had prevailed in every district around the city, and that no class of people had been altogether exempt from its attacks, although its prevalence had been much greater in the lower than the upper classes of society, among whom at that time no case of fever was known to exist, although about twelve months previously, and during last summer, it had appeared occasionally, and as in most other places where it attacked the rich, had been attended with consequences proportionally much more fatal. By the returns of the fever hospital at Waterford, it is proved, that during the months of December, January and February last, little more than one in sixteen had died of fever; but among the better ranks in that town and its neighbourhood, the fatal cases had constituted at least one-fourth of the total number attacked. The infrequency of fever here observed among the class of society in comfortable circumstances, is attributable to the superior cleanliness and ventilation of their dwellings, their more frequent ablutions and changes of apparel, and seclusion from those by whom infection is most frequently communicated. Little or no fever had appeared among the society of Quakers, probably from the same causes, operating in a higher degree. That seclusion exerts a strong preservative influence, was exemplified by facts derived from unquestionable authority. In the charity school of Killoteran, about three miles distant from Waterford, containing fifty-six boys, no case of fever had occurred, either during the last summer or since that time, when the disease was so prevalent in Waterford and the immediate vicinity of the school. The master had received particular directions to prevent all communication with the town or surrounding neighbourhood; these directions had been carefully observed. A fact of a different kind, by showing that comfortable circumstances and cleanly habits are alone insufficient to confer security, without a certain degree of seclusion, tends

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tends to confirm its preventive efficacy: many of the inferior classes, such as farmers, and others, whose circumstances were tolerably comfortable, and habits cleanly, suffered considerably from fever, arising most probably from their more frequent and continued intercourse with persons in the lowest rank, amongst whom it was chiefly prevalent.

3.—Judging from the annexed return of the fever hospital, we might be led to infer, that fever had begun to prevail epidemically in Waterford during the summer of 1817, as its chief increase was manifested at that season; but the concurring reports of various medical gentlemen, referred its commencement to the end of 1816, or January 1817. From that time it had advanced progressively; and had been most prevalent and fatal at the period of my inspection, and during some months antecedently.

To ascertain precisely the proportion which the number seized with fever, bore to the whole population of Waterford, was scarcely possible, as many persons were received into hospital from the adjacent country, and many also must have remained in their homes unnoticed; but supposing the number of such patients to be nearly equal, estimating from a comparison of the returns of the fever hospital and the total number of inhabitants, the sufferers from fever cannot be rated at less than one-ninth of the whole population. In a part of the city named the Carrigeen, inhabited by the poorest and most miserable classes, there are good reasons for believing that nineteen persons in twenty at least have suffered from fever; and in Murphy's-lane, containing sixty houses, every inhabitant has had an attack of fever within the last two months.

4.—The circumstances of the people at the time of its first invasion, were in many respects peculiar: poverty was extreme; in consequence of the failure of the crops in the year 1816, scarcity had prevailed to a degree almost amounting to famine; the seasons were most unusually humid. With these evils, want of employment, arising from the change from war to peace, and the failure or deficiency of manufactures, contributed in a high degree to increase the distress. The manufacture of stuff, which formerly was pretty extensive, has of late years greatly declined. One of the inspectors of the convalescent committee had very lately visited many of the weavers rooms, in all of which he had found but one loom at work.

The slaughtering of beef, from which the poor inhabitants derived some assistance, has also ceased. The miserable consequences thus arising from the concurrence of scarcity with want of employment, far exceeded all former example; for, in the year 1801, scarcity alone operated to produce distress. A physician to the public establishments in this city, informed me that he has frequently detected healthy men endeavouring to alleviate the pains of starving by lying in bed during the greater part of the day, in a state of reckless despondency.

The great neglect of cleanliness among the lower classes, a necessary consequence of extreme poverty, was stated also as a powerful cause for the spreading of febrile contagion.

5.—It may be proper to mention, that the fever did not materially differ from the ordinary kind which so generally prevails in Ireland. In the course of last autumn it was attended by dysentery, which proved remarkably fatal to the inhabitants of this city; three hundred persons, including some of the better ranks, having probably become its victims.

6.—In Waterford, which in this country first set the example of instituting an hospital for the reception of fever patients exclusively, in connection with other parts of the preventive system, it might be expected, from the humane activity of its managers, that extraordinary efforts would have been employed to oppose the progress of disease: the sick were removed from their dwellings to hospital; the rooms whitewashed, and clean straw supplied to the remaining family; and as ventilation was in many instances found to be defective, in some houses of the densely populous lanes, openings were made, when it could be done, to admit fresh air and diminish the noxious effects of the concentrated effluvia: the articles of dress made of linen, belonging to patients admitted to the hospital, were washed and exposed to the fresh air; private contributions for the support of the hospital, were most liberal, and aid was obtained from government by the advance of different

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Beneficial effect of a Fund established at Waterford.

sums on several occasions: but as these exertions, though great and unprecedented, proved ineffectual completely to arrest the progress of disease, additional measures were employed, which deserve attention. A Fund was established for the purpose of affording relief to the families of all persons received into the fever hospital, and nourishment to the convalescents from fever on their return to their dwellings; and also for cleansing the houses and clothes of the infected: a commodious house (the gift of a member of the corporation) has been fitted up with cisterns and boilers for washing, and a kiln for drying and fumigating the infected clothes and bedding: children left destitute by the removal of their parents to the hospital, or those who have not changes of clothes, are received into the house to undergo the operation of cleansing: notice is received there of all fresh cases of apparent fever, and lists are sent every morning from the fever hospital, of the persons admitted or dismissed on the preceding day: the city has been divided into districts, to each of which a physician and three other visitors, members of the committee, are allotted. The physician examines the applications of the sick to this house, visits the applicants, and should he find it necessary, sends them to the fever hospital: the other members of the district committees visit the patients dwellings, and see that all the measures of purification, consisting of whitewashing, burning foul, and supplying new straw, and cleansing the person and bedding of the infected families, have been duly performed; soup and fuel are also distributed to poor families when in a state of convalescence, as circumstances may require: but the success of the plan has not yet been decisive, though no doubt can exist that distress must have been greatly alleviated, and much sickness prevented by its humane operation.

The districts around Waterford, in the county, are in general unprovided with medical aid, except such as can be obtained from the city, with the exception of Tramore, where a physician resides.

7.—THE distress arising from this epidemic fever, has been much increased by the frequency of relapses, which have happened chiefly within the last four months: of 2,700 patients admitted to the hospital in the year 1818, 700 at least were either cases of relapse, or of a recurrence of the disease after some interval of time. Many patients relapsed several times, and such attacks were often severe; they were attributed to want of wholesome nourishing food, and of clothing and bedding, and to the neglect of cleanliness in the persons and apartments of the poor. It was reported that relapses were not so frequent in some parts of the country adjacent to the sea coast, as they had been in Waterford.

8.—No extraordinary effects on the constitution, with the exception of debility, seemed to follow the attacks of fever; and this, as might be expected, was most remarkable after relapses.

9.—AMONG the poorer classes, living in apartments crowded and ill ventilated during the whole night and great part of the day, and thus exposed to the effluvia proceeding from the sick, the disease has been observed very generally to extend to all the individuals of a family; seven or eight persons from the same rooms have frequently been admitted in succession to the hospital; but in the upper classes of society, such extension of fever through the members of a family was rarely observed. The circumstances of the rich will account for this immunity: their apartments are better ventilated than those of the inferior classes; and they are not, as the poor, exposed during the night, when the system is probably most susceptible of the influence of contagion, to its impression, continued during many hours, in small rooms ill ventilated, and favouring its propagation by neglect of every kind. Cleanliness in the persons and apartments of the richer classes, also contributes to their security; nor should we omit the superior dryness of their dwellings, as there is some reason for supposing that damp air acts as a vehicle of contagion; it is also probable that the more liberal use of animal food among the richer classes, by invigorating the system, may contribute to their security. On these principles may be explained the fact, that the troops in the garrison of Waterford have been healthy when fever raged in that town and its vicinity; and that ninety non-commissioned officers of the Waterford militia staff have suffered but little from fever during the last three years, though following their trades in different parts of the city. Of the medical attendants, not one in this city has suffered from this disease, though engaged occasionally in attendance on the fever hospital; two of them had a severe attack of dysentery, a disease, by some physicians, considered to be closely allied to fever.

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The housekeeper, nurse-tenders, and servants at this hospital have suffered severely, few having escaped the sickness, particularly during the last summer; and in two instances the termination was fatal: seventeen have been attacked within the last fourteen months; and of these, four have suffered two or three relapses. Here it would be injustice to pass over unnoticed the fearless intrepidity displayed by the members of the committee and medical gentlemen in their attendance on the hospital, which, at the time of my inspection, was so crowded, that in some of the wards the patients lay in three rows, and many of the beds contained two patients labouring under fever. In these circumstances the physicians continued their daily visits; and gentlemen of the town, managers of the institution, did not hesitate to enter wards which, accustomed as I am to attendance on fever patients, I could not remain in without some feelings of apprehension. This generous sacrifice of their personal safety is no longer necessary; more ample accommodation having been since that time provided. The extension of fever among the attendants at fever hospitals, will in the sequel appear to have been an almost universal occurrence in this part of Ireland. The return (No. 1) from the hospital, will show the progress of fever in Waterford, and the magnitude of those exertions which have been made for its suppression: but it is proper to observe, that the great assistance rendered by the "Convalescent Committee" to the families of patients, when received into hospital, has lately contributed to crowd its wards with cases of a slight nature, and to interfere with an exact comparison of this with other parts of the province, where less active measures have been employed or deemed to be necessary.

1.—In other parts of the county, including Dungarvan, Cappoquin, Lismore, Tallow and Kilmacthomas, fever seemed to be much less prevalent than in Waterford; and although in these places there had been an evident decrease, which seemed more permanent than on former occasions, still the disease did not appear altogether subdued. It had occurred in most districts within some miles around the above mentioned towns, but a different times. Thus in the parish of Rineogonah, the inhabitants had no fever when it raged in Dungarvan, though the malady has since reached them.

2.—Instances of exemption, worthy of remark, also occurred. Thus it did not prevail at Ballinavella, Kilnacaraga, and the two Bridanes, plough lands in the neighbourhood of Lismore, owing, as it is stated, to advice given by the roman catholic clergyman to the inhabitants of these places not to frequent Lismore or Tallow. Its attacks, as in Waterford and the immediate neighbourhood of that city, had not been confined to the lower classes, although crowding of apartments, defective ventilation, neglect of cleanliness, and the other consequences of poverty, were found to be as effectual here as in Waterford, in favouring its progress. At Cappoquin, fever was stated to have begun with the better ranks, and proceeded from them to the poor.

3.—The first increase of fever in Lismore, took place about November 1817, and it was most fatal in last September and October. It had appeared at Ballyduff on the south side of the river Blackwater, about twelve months ago: a person resident there, who died of fever, had bequeathed his clothes to an inhabitant of the opposite side of the river; and soon after this event, the disease spread through the family into which the clothes had been received. Here it proved more fatal at its first appearance than subsequently, and continued, from its commencement at Ballyduff, during eight or nine months at both sides of the Blackwater.

4.—Deficiency of fuel, arising from the wetness of the years 1816, 1817, was frequently assigned to me as a cause for the spreading of fever amongst the poor at that time. Turf or peat, the ordinary fuel in most inland parts of the country, could not be dried and brought home in a state fit for use: this must have occasioned a perpetual dampness of the clothing and apartments of the poor, debilitating their constitution, rendering the air of their dwellings more noxious by diminished ventilation, arising from the want of a fire burning within the flue; thus in various ways favouring the influence of contagion.

Poverty and its consequences in this, as in other parts of the county of Waterford, attended the commencement of fever; and the distresses of the poor have been much increased by the failure of the fishery, which occurred about the time when the disease

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disease became epidemical, at Dungarvan and other parts of the adjacent sea coast. At this period, several of the fishermen had become beggars.

Strangers were supposed to have introduced the disease into Tallow, as they resorted there in great numbers at the time when fever commenced. It is supposed that one-third part of the population of that town, suffered in some degree from fever.

5.—The progress of fever in this part of the county of Waterford, resembled that of the city and its vicinity. It had in general become milder, and also of shorter continuance; a strong indication of diminished severity, though not of lessened contagion.

6.—The preventive means used in this quarter of the county, were similar to those already stated. Temporary fever hospitals had been erected, supported by private and public contribution, also by aid from government, and exertions great and generous were employed to prevent the extension of disease. A measure of relief pursued at Cappoquin, deserves mention: the distribution of clothes, in cases of great distress, by a charitable society instituted for that purpose; the miserable condition of the poor rendering such relief peculiarly necessary, and obviating a frequent cause of fever. The benefit of such societies is not limited to the relief they afford; they disclose the condition and wants of the poor to the upper classes; and thus approximating the different orders of society, tend to give them a community of interest and feeling.

7.— Relapses were very frequent in every quarter of the county of Waterford, and greatly augmented the distress.

8.—No peculiar effects on the constitution, were observed to result from its attacks.

9.—Its contagious nature was more strongly evinced in this, than in the eastern part of the county; for it not only spread through whole families, but several clergymen, both protestant and roman catholic, and some physicians, were attacked. In the hospital at Lismore, every nurse-tender had suffered, and some of them gave up their places from apprehension. The physician was also a sufferer; and some of the clergy, protestant and roman catholic, in the neighbourhood of Tallow, died of fever.

Observations

From a review of the different reports obtained in this county, it results that fever, with scarcely an exception, has prevailed in every district, commencing not exactly at the same time in different places, but at a period generally corresponding with the distresses arising from the scarcity:

That in this county it is by no means subdued, although its frequency has been progressively diminishing, and its severity is in general mitigated:

That the evils resulting from it, have been greatly enhanced by relapses:

That its contagious nature has been strongly evinced by its almost universal extension among the nurse-tenders in hospitals, and the attacks of fever which have occurred among the physicians and clergy engaged in the duty of attendance on the sick:

Preventive System.

That the preventive system, in all its details, is now very actively pursued in the town of Waterford, where the disease still appears to be prevalent to a greater degree than in other parts of the county.

County of Cork.

County of Cork.

IN the county of Cork, such places were inspected as were judged likely to afford satisfactory information relative to the prevalence and character of the epidemic fever, and the means which had been adopted to restrain its progress.

The great extent of this county, and the sufferings which its inhabitants have undergone, claim for it peculiar notice; but to avoid useless repetition, reference will occasionally be made to the statements contained in the report on the county of Waterford.

1.—From the low and damp situation of Cork, and the injury which its dense population must have sustained by the change from war to peace, it might be expected

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expected that epidemic fever would there have made great progress, more especially when rendered active by bad seasons, giving rise to scarcity amounting almost to famine; accordingly fever has prevailed to a most extraordinary extent. The number of patients who passed through the fever hospitals in the year 1815, amounted to 726; in 1816, these rose to 995; in 1817, to 4,617; and in 1818, to the enormous amount of 10,228: so that in the two last years, a number of patients exceeding one-seventh of the population of Cork, estimating this at 100,000, has passed through the different fever hospitals of that city. Such was the increase of fever patients in the year 1817 and part of 1818, that two additional hospitals were required to accommodate all the applicants labouring under fever: these hospitals have since been closed; the last of them at the period of my inspection, on the 1st of March 1819.

It is most satisfactory to report from various concurring testimonies, as well as from returns obtained from the hospitals, that fever has so much declined in Cork, as to render it questionable if the disease be now more prevalent than it has been in ordinary times; no doubt however can exist that fever still prevails in Cork, but probably in a degree little exceeding its usual frequency in the populous towns of this county; and its progressive decrease, as indicated by reports from the hospitals, is universally acknowledged.

2.—It would seem to have prevailed in Cove, a small sea-port town near the mouth of the harbour, and seven miles distant from Cork, at an earlier period than in this city; and it deserves remark, that in two places so similarly circumstanced as Cove, and Passage near to Waterford, fever should have made its appearance at an earlier date than in either of these cities.

No district in the vicinage of Cork had been exempt from fever; and its progress seems to have been pretty similar to that observed in other places in this province, visiting the upper classes with great severity, and at its commencement proving very mortal, but almost totally ceasing among them in proportion as its frequency increased among the poor.

3.—Its commencement was generally referred to the latter part of 1816, or beginning of 1817. It increased manifestly in the spring of 1817; when the beds, which had been hitherto sufficient for the fever patients of the town, were found unequal to the demand, and a greater number were provided.

4.—Great scarcity and bad quality of provisions; increase of failures in trade, owing to the transition from war to peace; mendicants flocking to the city, and the needy in general crowding thither in search of employment, were the awful circumstances marking this eventful period.

5.—Dysentery, which showed itself in the course of last autumn, did not appear to have been so prevalent or fatal here as in Waterford, and the fever had changed its character and become milder.

6.—The preventive means were pursued most actively: patients were received into hospitals, where every advantage to be derived from such establishments was obtainable; whitewashing, ventilation and fumigation occasionally were employed in the dwellings of the poor; the clothes of the patients received into hospitals, were ventilated or steeped in cold water; the bedding and clothes of the family remaining at home were not washed, but clean straw was supplied, and the old straw bedding occasionally destroyed; coals were also given to some poor families; soup also had been distributed to aid the distressed, and promote the recovery of convalescent patients: fever has declined almost within its ordinary limits; and the benevolent promoters of the measures so actively pursued for its suppression, have the satisfaction of reflecting that their dearest relatives, friends and fellow citizens, are no longer threatened by the visitation of this awful calamity.

7.—Relapses occurred very frequently; at one hospital it appeared that a large proportion of the patients dismissed, returned in a relapse of fever. This took place during the summer months, and among the lower ranks almost exclusively.

8.—The effects produced on the constitution of the sufferers from an attack of this disease, were not different from those observed in Waterford.

9.—Its

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9.—Its extension through families was a very general occurrence among the poor, and was not very infrequent among those whose circumstances were comfortable, if cleanliness and ventilation had been neglected; but it rarely spread among the upper classes. Nine physicians, eight of them engaged in attendance on the poor in different establishments, were attacked, and of this number three died; these unhappy events occurred in the year 1817. Every medical person, including two apothecaries, connected with the South Fever Asylum, had an attack of fever; the apothecaries to such institutions were general sufferers: the nurse-tenders, who in the performance of their duty were greatly exposed to infection, also suffered; the greater number had attacks of fever, and some became its victims. Other persons engaged in various offices with the sick, the fumigators of the houses, and barbers of the hospitals, were attacked, and it was evident that persons occupied with attendance on the sick poor at that time, suffered in a degree of frequency much exceeding that observed in any other class of people not similarly exposed. The only cause to which this could be assigned, was the contagious nature of the malady; for in ventilation, cleanliness and general arrangements, the hospitals were not merely unexceptionable, but in many respects deserving of imitation in other places.

In several of the public establishments, the foundling hospital, depôt for convicts, and gaol, few or no cases of fever then existed.

In the latter place, five cases of fever had not occurred from the commencement of the year 1817 to last August: this was attributed, and apparently with good reason, to the practice which had been adopted, on the admission of the prisoners, of washing and cleansing their persons, substituting a clean gaol dress for their own clothes, which were exposed to heat in a stove or oven, steeping the bedding of all those who were unusually filthy in bleaching liquor, and lastly, exposure to the process of stoving. Two prisoners had died of dysentery, but none of fever.

The practice of supplying gaol dresses has been discontinued, and some prisoners have sickened with fever, and a few patients of this kind were in the hospital at the time of my visit. The gaol was crowded to a greater degree than usual, and it had generally contained between three and four hundred prisoners.

Bad effects of Nuisances.

Strong facts were stated to me on the existence of various nuisances, some of which I witnessed; and I was informed by the best authority, that one place where a number of lanes intersect, was in such a state from disease and filth, that some of the physicians more than once declared it to be quite unsafe for them to visit there. Deposits of filth and putrifying animal substances are suffered to remain in the crowded parts of this city; and I was informed that the powers vested in magistrates as to nuisances were insufficient, as the dung is the property of those who collect it, and cannot be removed without a tedious law proceeding, which the proprietor by various contrivances can evade. This evil requires a remedy; for whatsoever opinion may be entertained as to the power of animal effluvia to generate fever, no doubt should exist that air tainted and impure, debilitates the human system and favours the progress of contagion; and this may contribute with other causes, at all times, to maintain fever in the large cities of this province, where such nuisances are too much neglected.

1.—In other parts of the county of Cork, the progress of this epidemic fever was similar to that observed in the city. At Cove, which previous to this time had not produced four cases of fever annually in a population of about 7,000, the increase of disease had become so great that it was deemed advisable to fit up a number of huts for the reception of fever patients. It seemed here equally contagious as at Cork, spreading through families almost universally; and it was observed of one house, that every family that occupied it as a dwelling during two successive years was attacked with fever. It extended to the attendants at hospitals: a physician, one of the apothecaries, and some of the nurse-tenders, were seized with the disease, and one of the latter died. It may be right to mention that soldiers, ill of fever, are landed from the transports and received into the military hospital at this place, and that six patients in fever had been admitted from the transports within the last month. In this island fever has greatly abated, or is now very little prevalent.

In other places of this county, Kinsale, Bandon, Fermoy, Mallow, Mill-street, Castle Martyr, Middleton, and Youghal, its progress was very similar to that

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observed in Cork; commencing at various periods after the wet season of 1816, prevailing in every district around these places, chiefly among the lower classes, but not altogether limited to these, but occasionally visiting individuals in better circumstances; and in this class it prevailed most at its commencement, and with severity and danger proportioned to their elevation in society.

2.—According to several reports, situations damp and elevated seemed to favour its progress. Thus in a mountainous track near Rathcormuck and Watergrass Hill it was extremely prevalent: in one family eight persons were attacked, and of these four died. In the neighbourhood of Bandon also it was said to have prevailed with most frequency and severity in situations damp and mountainous. Here it may be remarked, that in some instances it appeared to have been less prevalent, and generally to have declined more rapidly in places where the subjacent rock consisted of limestone, than in those differently constituted. Thus in Copsetown, in the neighbourhood of Mallow, fever was reported to have been much less prevalent than in any other place in that neighbourhood: it is elevated and exposed, and built over limestone.

Judging from the accounts of different medical gentlemen, from hospital reports and inspection of the patients, I would infer, that in all the above mentioned places and surrounding districts fever had considerably declined; that the decrease for some time past has been progressive, and does not resemble those fluctuations which have occurred during its former course. At Mallow, Fermoy, Kinsale, Bandon, and Youghal, it might be said in general to have approached its ordinary limits; in other places it had almost totally disappeared: thus at Middleton the temporary fever hospital had been closed, and not a case of fever was said to exist within four miles of that town.

3.—As to the time of its first appearance in different parts of the county of Cork, this was referred, according to different testimonies,

In Bandon - - - - -	to Spring 1816.
Fermoy - - - - -	Uncertain.
Cork - - - - -	Summer of 1816.
Cove - - - - -	September 1816.
Cork - - - - -	October 1816.
Mallow - - - - -	October 1816.
Bandon - - - - -	January or February 1817.
Youghal - - - - -	Midsummer 1817.
Castle Martyr - - - -	Midsummer 1817.
Middleton - - - -	Beginning of 1817.
Cork - - - - -	Spring of 1817.
Bandon - - - - -	Spring of 1817.
Mills-street - - - -	Spring of 1817.
Kinsale - - - - -	Later than other places.
Skibbereen - - - -	Spring of 1817.
Fermoy - - - - -	Spring of 1818.

Now from a collation of these testimonies, if we reject those which appear to differ much from the rest, it will follow that fever began to prevail epidemically in the county of Cork early in the spring of 1817, or the winter of 1816—1817; and as to the variations which appear in the different statements here given, I would only observe, that it is difficult to fix exactly the time when a fever begins to spread epidemically in a country which is constantly infested with this disease; more especially in places where there are no fever hospitals, or records kept of the number of cases. At Youghal and Kinsale, somewhat similarly circumstanced, and places of little resort, it seems to have commenced later than in other parts of the county. A census of the population in Youghal was taken in March 1817, at which time it was found quite free from fever; but the commencement of epidemic fever seems evidently connected with the great movement which took place in the county on the first impressions arising from scarcity.

4.—The circumstances of the people at its commencement were generally stated to be such as are already mentioned in the reports of Cork and Waterford. Scarcity of wholesome food, combined with want of employment, extreme poverty, and wretchedness, great despondency; and in towns, defective ventilation of dwellings, I MUNSTER.

lings, and general neglect of cleanliness, were almost universally assigned as the condition of the inhabitants of the county of Cork at this time. But a few years ago, the fishermen of the town of Kinsale were never known to become mendicants; now they are often reduced to this necessity: the fishery on this coast, as at Youghal and Dungarvan, has been less productive than formerly. In some places, toward the west side of the county, the influx of strangers and mendicants was more dwelt upon than in other parts: thus, at Mills-street, it was stated that crowds of half-starved wretches, joined by the idle and ill disposed, passed through the county, seizing on potatoes and meal; and such was the violence of their importunity for food, that the distribution of soup became almost a service of personal danger. The number of strangers and mendicants who resorted to the western parts of the county of Cork, bordering on the county of Kerry, was extreme. The Kerry labourers, and many of the people west of the town of Bandon, emigrate during the season of harvest, and their wives and children at these times generally become beggars. The increase of this evil must have been enormous at the time of scarcity, and amongst a people with whom emigration and mendicity are annual habits; and must have contributed powerfully to extend fever through a population unemployed, debilitated, despondent, and in every respect susceptible of impression from this calamity.

5.—THE disease was, in general, reported to be either similar to the ordinary fever of this country, or to be merely a variety of this disease, modified by the peculiar circumstances of the people at the time of its invasion. At Mallow, deaths in the hospital were occasioned chiefly by a disease allied to dysentery, which proved at least as mortal in this place among the poor as in Waterford.

6.—THE preventive means employed in the large towns were similar to those adopted in Cork. Hospitals were prepared on a scale accommodated to the size of the town and the means of its inhabitants: for their support, the contributions were in many instances large and generous, and the aid of government was occasionally given: places already built were often applied to the purpose; and in some instances, buildings of the rudest construction, with walls composed of turf-sods, were fitted up for the accommodation of the sick. Such was the conviction the poorer classes felt of the necessity of the separation of the sick from their families, that in some instances they erected huts by the sides of the fields, to which they removed those who sickened with fever; for the spreading of this disease was always apprehended, because it was an almost universal consequence of its appearance in a family.

7.—Relapses were frequent in every part of the county, without exception, but among the poor chiefly or exclusively; most commonly during the year 1818, and in proportion as the disease assumed a milder form.

8.—It extended through the families of the lower ranks very generally, as in other places. This was the invariable report at Youghal, Castle Martyr, Middleton, Bandon, Kinsale, Fermoy, Mallow and Mills-street; and sometimes it appeared to spread among those in better circumstances. At Fermoy the postmaster's wife and three children had an attack of fever; and in about two months after this event, he sickened and died. Six medical men were attacked with fever in the neighbourhood of Fermoy and Mallow, and two of them fell victims to it. The nurses and inferior attendants at fever hospitals suffered very generally, as well as other persons employed about these establishments. In some parts of the county of Cork, bordering on the county of Kerry, it was reported that one-half of the population only, and that in others scarcely one-third had remained exempt from an attack of fever.

County of Kerry.

County of Kerry.

THE circumstances of the county of Kerry were peculiarly favourable to the progress of fever; remote from large towns, and deprived in too many instances of the advantages which result from resident landholders, its sufferings were not perhaps exceeded by those of any other county in the kingdom.

1, 2, 3.—THE time of the first appearance of fever, its greatest prevalence and mortality, corresponded nearly with the accounts received in the county of Cork;

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but at Dingle and its neighbourhood it was reported to have appeared at a much later period than in other parts of the county of Kerry; and there was no fever there in August and September 1817, when extremely prevalent in other places. This was to be accounted for by its superior advantages over other parts of the county, arising from the linen trade and the fisheries; but something should also be attributed to the remote and insulated situation of the place.

Deplorable state of the afflicted poor.

4.—The condition of the people in this county greatly furthered the progress of disease. This may be inferred from the following report of their circumstances at the time when fever became epidemic: fuel scarce and dear; farmers generally failing, in consequence of the change from war to peace; beggars passing through the county in crowds, seizing on provisions; great deficiency of employment, and scarcely any manufacture in their towns; the want of food so pressing in the neighbourhood of Tralee, that seed-potatoes were taken up from the ground and used for the support of life; nettles and other esculent wild vegetables eagerly sought after to satisfy the cravings of hunger; influx of strangers to such a degree that it was emphatically said, "the whole country was in motion," and female mendicants, often carrying about children suffering from fever in their arms, and it was reported to me that a husband, wife and five children, were seen walking in the streets of Killarney, all labouring under fever. Spreading of disease under such circumstances was inevitable, and its progress was furthered in no small degree by general despondency, and by neglect in the persons and dwellings. It extended through families almost universally; and such was the conviction of its contagious nature, derived from sad experience, that the ties of family affection were in some instances dissolved, and the nearest relatives, when seized with the disease, were forced out of the cabins into huts generally placed by the road side, to prevent infection and obtain charitable relief: *this* was, I believe, most liberally supplied; for it is but justice to declare, that the resident gentry were feelingly sensible to the distresses of their countrymen, and disposed to render them every assistance which their means could afford. It has declined considerably in this county, as would appear from the reports received at Tralee, Killarney, Tarbert and Listowel; but cases of fever among the poor still present themselves at Tralee and Killarney; and at Dingle in the parish of Ventry, where the population is dense, there are still a good many cases of fever. In the neighbourhood of Listowel and Tarbert its frequency has considerably diminished.

5.—The fever was very generally stated to have been more frequently attended with petechiæ, or spots, than usual; a remark which has been made in most parts of this province. Its character has been in general changed throughout the county, and it has assumed a milder form; but at Tralee cases of a severe kind had been admitted to the fever hospital within some weeks past.

6.—The preventive means seemed to have been employed on a more contracted scale in this than in other counties. Medical aid was reported to have been wanting in many districts; Kenmare, Castle Island, Kilorglyn and Ivragh, were said to be destitute of such assistance, and hospitals for the relief of fever patients were but thinly scattered throughout this county.

7.—As in other parts of the province, the distress was much aggravated by the frequency of relapses occurring, from the time that fever first made its appearance.

8.—The constitutions of those who recovered did not appear to have been injured. At Killarney dysentery was combined with or succeeded fever in some instances; but it did not there produce fatal consequences, as in other parts of the province.

9.—That it extended itself through families of the poorer classes has been already stated. The medical and other attendants on the sick have been severe sufferers; and it was observed to spread occasionally through families in comfortable circumstances also, in cases particularly where defective ventilation of the dwellings was observable: at Tralee, it was reported by an eminent physician, that in a respectable family living at the distance of about twelve miles from the town, in a period included between the 1st of December and 16th of March 1817, twelve persons had been

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been attacked successively with fever. It was supposed to have been conveyed by servants, labourers and beggars, to the houses of the upper classes. The nurse-tenders in the hospitals of Tralee and Killarney suffered without any exception, and the physicians received the infection in a proportion far exceeding that observed among other persons in the same rank of life. At Tralee, of nine medical gentlemen who might be considered as peculiarly exposed, four were attacked, and two became victims of the disease: at Killarney, five out of seven of the medical gentleman sickened; two of these had severe illness: thus it appears that of sixteen medical persons, nine were attacked and two died; an occurrence proving that fever was not limited to the lower ranks, in cases of sufficient communication with the sick. The fact also confirms the assertion as to the greater proportional mortality produced by fever in the higher classes of society; for in the hospitals of Killarney and Tralee, the mortality did not exceed one in seventeen.

In this county ten roman catholic clergymen died of fever; these unhappy events occurred chiefly in the year 1818; in the discharge of their office of attendance on the sick, they are peculiarly exposed to contagion: three protestant clergymen also were reported at Tralee to have died of fever, and several no doubt have suffered from slight attacks, which escaped notice or recollection. It should be observed, that none of the small detachments of troops quartered at Ross Castle, in the neighbourhood of Killarney, sickened with the disease when so prevalent in this district; proving that seclusion from the sick, aided by comfortable circumstances and habits of cleanliness, affords a certain degree of security; and this remark applies very generally to the army, so far as I could obtain information respecting it in this province. Here I may observe that the immunity of this class of persons most probably depends on the causes here assigned; for when exposed in circumstances similar to those of the lower classes, they suffer equally with them: thus at Fermoy in the county of Cork, in the 92d regiment, twenty-five cases of fever had occurred from the 13th of last February to the 4th of March; and of these, thirteen had the typhoid form, and two died. The regiment had been for some time engaged in severe duty for the revenue, and had lately made a long march in very bad weather.

County of Limerick.

County of Limerick.

1, 2, 3.—IN the county of Limerick, the misery occasioned by epidemic fever has not been exceeded in any of the counties hitherto reported on. According to the medical gentlemen of the city of Limerick, its commencement should be referred to the spring, or early part of the year 1817; however it is not improbable that it began at an earlier period; and that distress, arising from scarcity and other causes, increased the resort to hospitals about that time. No doubt can exist of its having prevailed in every district of the county of Limerick; though the want of establishments for the reception of fever patients in this county, except in the city of Limerick, renders it somewhat difficult to obtain information as to the character and progress of the disease through the county at large.

Frequency of fever, and great mortality.

Its frequency seems to have been greatest in the year commencing from November 1817; and it was most mortal during the four months of November and December 1817, and January and February 1818, when the numbers dying in hospital amounted to more than one-seventh of the total number sent out. It was conjectured, and I believe with good reason, that one-fourth of the inhabitants of the town had sickened with fever; and at one time the hospital was so crowded, that in many of the rooms there were five ranges of beds strewed on each floor, some containing six, many four, and few, very few, appropriated to one patient; so that in a small room of twenty-four square feet, the number of patients was not unusually forty. But this miserable state did not long continue: the military hospital in the square was granted by government for fever patients, on the application of the governors of St. John's hospital, and the preventive system was continued with a degree of perseverance and activity proportioned to the exigency of circumstances; yet it has been confidently stated that some thousand persons sickened in their homes, and there received medical treatment, from the impossibility of accommodating them in the institutions. So numerous were the admissions to the hospitals in the year commencing January 24th 1817, and ending January 23d 1818, as to exceed more than

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seven times those of some of the years most productive of fever previous to 1816. This unusual frequency of fever is partly attributable to the peculiar circumstances of some part of this city, crowded to excess with a population miserable in the extreme, dwelling in lanes filthy and neglected, and so narrow that of some of them, it may be said without exaggeration, their breadth does not exceed eight or ten feet, that fresh and pure air can scarcely ever find access to them, as nuisances of the most offensive kind seemed every where to abound. Happily, however, the influence of these causes has not been sufficient to prevent a considerable decrease of fever in this city.

4.—SCARCITY of provisions attended the commencement of epidemic fever here, as in other places. The poor in some parts of the county were compelled to collect esculent plants in the potatoe gardens; and I was assured that patients had been received into the hospitals, who had endeavoured to support life for some days together with the leaves of the wild turnip and other plants of this tribe. Deficiency of fuel, owing to the wetness of the season; an unusual resort of strangers and mendicants, to whom, in country places, the commencement of the sickness was frequently attributed, were evils perhaps more prevalent here than in other counties of this province; whilst want of employment, increased by failures in trade, added to the distress in a degree altogether unprecedented.

5.—THE disease, as the returns (No. 18.) from St. John's hospital clearly prove, now presents a different form; and diminishing in frequency, has not become more mortal, as often happens, but on the contrary has assumed a milder type.

6.—IT would be mere repetition to enter into a detail of the means employed in the hospitals to counteract the progress of fever. One of the hospitals (St. John's) has been long established, and conducted on the most approved principles, for the prevention of fever; its arrangements are in many respects entitled to imitation: its registry kept with order and precision; its managers most humane, zealous and intelligent; and sufficient funds seem alone wanting to extend its utility. Many dispensaries have been established throughout the county; but no fever hospitals, except in Limerick.

7, 8.—RELAPSES were frequent here, as in other places, and were attributed to errors in diet; they were almost totally confined to the lower classes.

9.—IT extended through families in the lower ranks very generally. Five of the physicians were attacked with fever: the event in one instance was fatal. The apothecary to St. John's hospital had three attacks of fever. All the nurse-tenders and housekeepers suffered in different degrees. This hospital has so often changed its nurse-tenders, chiefly from this cause, that it has had sixty-three within the last six months. Four of the nurse-tenders, I was informed, were lying ill of fever at the time of my visit.

Many of the roman catholic clergy in Limerick had suffered from the disease, and some of these more than once: one was reported to have taken fever in the Square hospital, of which he died. Several of the protestant and roman catholic clergymen in the diocese suffered; among these were reported the protestant clergyman of Rathkeall, and the roman catholic clergyman of Drumcallachar, to both of whom it proved fatal.

It may be right to observe, that the want of sewers in Limerick, particularly in the old town, must greatly tend to impair the health of its inhabitants.

County of Tipperary.

County of Tipperary.

1, 2, 3, 4.—IN the county of Tipperary, fever has declined more perhaps than in other parts of the province. This was inferred either from an inspection of the hospitals or conference with medical or other gentlemen at Clonmell, Cahir, Cashell, Tipperary, Carrick on Suir, Roscrea and Templemore.

At Clonmell the frequency of fever has been so great, that in a population of about 15,000 persons, three hospitals, together with sheds, in all containing 250 beds, were required for the accommodation of the sufferers: this happened in last July. The applications for admission amounted to from twelve to fifteen daily, and at times rose to twenty. It was calculated that one-third of the inhabitants, or more, if dysenteric patients be included, had been sufferers. On March 14th ultimo, it appeared that the number of beds had been gradually reduced to sixty-three; the patients in hospital were only twenty-one, and three convalescents, and the applications for admission did not exceed six per week: such had been the decline of fever; and most medical gentlemen supposed it to have fallen to its original standard of frequency. Similar reports were obtained at Cahir, Cashell, Tipperary and Templemore: at Roscrea and Carrick on Suir, the malady was not quite subdued, though greatly diminished. At the latter place its frequency has often fluctuated, but it has never been observed to decline so steadily as at present. At Roscrea the sufferings of the poor had been very great, similar to those reported in the county of Limerick. A temporary hospital had been erected, supported by private subscription and grants from government: at the time of my visit, it was closing from want of funds, though sickness still continued to spread through poor families. Its greatest prevalence in every part of this county occurred during the last summer and autumn: at the latter period, dysentery prevailed in most parts of the county, and proved very fatal in Clonmell. In other respects, reports corresponded with those received from other counties. In the brigade of artillery, during three years, from January 1816 to the present time, not more than five cases of simple fever had occurred, and but one fatal case. No class had been altogether exempt from its attacks; but the poor suffered chiefly from its frequency, and the richer classes more in proportion from its fatality.

5, 6.—The time of its first appearance was referred, by most medical gentlemen, to the spring, summer, or autumn of 1817. Its progress and the means adopted for its prevention were similar to those of other counties, and it seemed equally infectious, spreading among the medical and other attendants at hospitals.

7.—Relapses were very frequent, and at Clonmell proved very fatal. It seemed equally infectious here as in other counties. At Clonmell, five medical attendants were attacked. An active, zealous, and humane governor caught the disease, and all the nurse-tenders were attacked: two medical gentlemen died of it. The surgeon and apothecary had both been ill of fever during last April; and a physician and one of the nurse-tenders laboured under it at the time of my visit. Mendicants were supposed chiefly to have given origin to fever at Carrick on Suir, and many facts were stated which confirmed this opinion. No sickness had prevailed at Carrickbeg, till a sick family came into that place from Dungarvan.

The total decline of manufactures in Carrick on Suir have greatly added to the distresses of the inhabitants, and probably contributed in no small degree to extend the malady among them. It deserves remark, that fever has declined much more in the county of Tipperary than in the contiguous county, Waterford. The nature of the soils of these counties may in part explain the difference; the county of Tipperary consisting chiefly of limestone, which is not found in the other county, particularly in the neighbourhood of Waterford.

Thus it appears, that in every part of the five counties of this province, the epidemic fever has prevailed to an extent unprecedented in the recollection of any person living: that it is now generally on the decline, which appears more steady than at any former period; and that in many places it has almost totally disappeared: that it commenced, in most parts of the province, about the latter part of 1816, or beginning of 1817, with the scarcity of provisions and general distress consequent thereon; and that the peculiar circumstances of the people, arising from want of employment, have greatly furthered its progress. Its contagious nature is most fully established by its seizing on the medical and other attendants on hospitals, with scarcely any exception, and by its prevalence among the roman catholic clergy, as well as by its almost universal extension among the poor; it would, therefore, appear highly probable that its diffusion arose chiefly from strangers and mendicants moving through the country, carrying with them the seeds of infection.

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The crowding of apartments and the increase of filth, and neglect, the consequences of the condition of the people at that time, must have tended also to disseminate contagion. These opinions respecting its contagious nature, seem to have taken complete hold on the minds even of the poorer classes, as appears from the practice so generally followed by them, of excluding from their families those who had sickened with fever.

As to the preventive means to be adopted, in order to obviate its future increase or recurrence, it is evident that every measure serving to better the condition of the people, and to diminish pauperism and mendicity, must have a tendency to render fever less frequent, by obviating those causes which favour its progress. But these are not perhaps so immediately within our reach as others which affect the source and origin of the evil. The encouragement of local societies for the relief of the poor through the country, would disclose their wants, make known the appearance of fever among them, and otherwise produce good results, by drawing together the different classes of society, which in the country are too distinct. The establishment of temporary fever hospitals, under the management of such societies, actively instituted and vigorously supported on the first appearance of fever in a district, would tend to check its progress. Much want of information occasionally appeared, as to the best mode of conducting such establishments: in some hospitals various plans of a superior kind were in use, unknown in other establishments; at the same time defects were to be found occasionally, which information could have supplied. The only remedy in this case appears to be the adoption of some plan by which information can be communicated to some common centre, and again diffused in every requisite direction. In every plan that may be devised, I would discourage the resort of the poor to towns in times of distress; for I am persuaded this has been and still continues a fertile source of disease. The distribution of publications proceeding from persons well informed on the state of the poor and the means of obviating sickness, and having sufficient authority, derived from knowledge and experience, to command attention, would also contribute to prevent or restrain the progress of fever.

FRANCIS BARKER, M. D.

RETURN, (No. 1.)

Waterford.—House of Recovery.

Date.	Patients admitted.	Discharged, cured.	Died.
1817:			
January - -	52	48	3
February - -	44	45	1
March - -	56	48	2
April - - -	40	52	4
May - - -	71	48	4
June - - -	77	75	3
July - - -	77	72	1
August - -	101	85	4
September -	84	90	1
October - -	104	94	5
November -	100	94	2
December -	124	118	4
1818:			
January - -	127	100	6
February - -	104	113	4
March - -	100	107	1
April - - -	118	116	4
May - - -	114	108	8
June - - -	200	156	3
July - - -	313	261	5
August - -	340	322	9
September -	325	306	11
October - -	332	328	17
November -	308	296	18
December -	348	319	23
1819:			
January - -	377	317	23
February - -	328	283	16
March - -	357	396	25
TOTAL -	4,721	4,397	207

At the end of the year 1817, remained in the hospital, 50 patients.

At the end of 1818, remained in the hospital, 138 patients.

On the 20th of February 1819, remained in the hospital, 206 patients.

Seventeen of the nurses and servants of the house have been attacked with fever within the last fourteen months; four of them have been attacked twice or thrice within the above period.

One nurse died from fever.

There are at present 159 beds laid in the hospital, and the wards of the Leper House, which are appropriated to fever patients; 93 of them have iron bedsteads; 66 are on the floors of the wards; and there are 44 patients obliged to lie double.

The number of patients admitted from the opening of this House of Recovery, in the year 1799 to the 1st of March 1819, were 10,018, of which, up to 1st of March 1818, were 6,629, about 348 per year; in the last year, above nine times the average.

The expenses during the last year amounted to £. 3,628. 13*s.* 2*d.* of which sum £. 800 was received from the Government, the rest supplied by local taxation, annual subscriptions and donations.

A very large sum was also subscribed for relief of dysenteric patients and convalescents from fever.

Return from the *Waterford* House of Recovery, in quarterly periods, commencing January 1817.

MONTHS.	Patients admitted.	D° cured.	D° died.
1817:			
January, February, March	152	141	6
April, May, June	188	175	11
July, August, September	262	247	6
October, November, December	328	306	11
1818:			
January, February, March	331	320	11
April, May, June	432	380	15
July, August, September	978	889	25
October, November, December	988	943	58
1819:			
January, February, March	1,062	996	64
Total	4,721	4,397	207

In the first week after the convalescent committee had commenced their operations in January 1819, the number of patients admitted to the Fever Hospital amounted to 115.

The number of patients admitted in the week ending March 30th ultimo, amounted to 44 only: thus it is evident, that in Waterford, fever was considerably on the decline at that period.

RETURN, (No. 2.)

From the temporary Fever Hospital at *Cappoquin*, County of Waterford; commencing February 6th, 1818.

	Patients.
From February 6th to July 4th, 1818, dismissed cured	117
Remain in fever	10
Convalescent	16
Died	3
Total	146

From July 4th to February 6th, 1819, the fever cases amounted to 73 only.

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RETURN, (No. 3.)

From the temporary Fever Hospital at *Lismore*, County of Waterford.

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
From May 18th	13	4	1
June - - -	24	19	1
July - - -	31	20	—
August - -	35	36	1
September -	17	26	—
October - -	19	14	1
November -	32	27	—
December -	28	21	1
1819:			
January - -	23	20	1
To February -	12	13	—
TOTAL - -	235	200	6

RETURN, (No. 4.)

From the temporary Fever Hospital, at *Tallow*, County of Waterford.

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
From June -	18	18	—
July - - -	38	37	1
August - -	27	26	1
September -	35	24	1
October - -	11	2	—
November -	27	26	1
December -	27	21	1
1819:			
January - -	14	12	2
To February 24th - -	10	—	—
TOTAL - -	207	166	7

Remaining in hospital 21, on February 24th.

Remaining in hospital 13 patients, on March 2d.

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RETURN, (No. 5.)

From the House of Recovery at *Youghal*, County of Cork.

Date.	Patients admitted.	Discharged cured.	Died.
1817:			
January	5	5	—
February	3	3	—
March	5	4	1
April	8	8	—
May	6	6	—
June	10	10	—
July	15	15	—
August	28	28	—
September	33	31	2
October	44	43	1
November	45	44	1
December	33	32	1
1818:			
January	32	31	1
February	34	31	3
March	40	40	—
April	33	31	2
May	27	22	5
June	22	21	1
July	43	42	1
August	33	30	3
September	30	30	—
October	35	34	1
November	24	24	—
December	19	19	—
1819:			
January	16	16	—
TOTAL	623	600	23

Remaining in the hospital, at present, eight patients, all convalescent.—February 25th.

From July 1816 to July 1817, the number of patients admitted to the hospital amounted to 51, of whom two died.

From July 1817 to July 1818, the number amounted to 386, of whom 16 died. The extern cases, during the latter period, were 936.

From July 1818 to February 16th 1819, the number of patients admitted to the hospital amounted to 205, of whom four died. During that period, the extern fever cases were 247, of whom four died.

I.
MUNSTER.

RETURN, (No. 6.)

From the House of Recovery at *Youghal*, in quarterly periods, commencing January 1817.

Months.	Patients admitted.	Discharged cured.	Died.
1817:			
January, February, March - -	13	12	1
April, May, June - - -	24	24	—
July, August, September - -	76	74	2
October, November, December -	122	119	3
1818:			
January, February, March - -	106	102	4
April, May, June - - -	82	74	8
July, August, September - -	106	102	4
October, November, December -	78	77	1

In January last, sixteen patients only were admitted; and on February 25th, eight atients, all convalescent, remained in the hospital, which contained twenty beds.

RETURN, (No. 7.)

From the temporary Fever Hospital at *Middleton*, County of Cork.

Admitted to the temporary Fever Hospital, 74 patients, of whom two died. The hospital is now closed.

RETURN, (No. 8.)

From the Fever Hospital in *Cork*.

Date	Patients admitted.	Discharged cured.	Died.
1817:			
From January	161	140	8
February - -	151	148	8
March - -	159	160	5
April - - -	181	173	6
May - - -	230	221	6
June - - -	219	229	9
July - - -	213	190	5
August - -	239	220	7
September -	388	324	12
October - -	425	426	19
November -	390	322	11
December -	389	358	11

(continued)

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Return, (No. 8.)—Fever Hospital, Cork—*continued.*

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
January - -	327	301	13
February - -	344	320	11
March - -	415	390	12
April - - -	411	394	4
May - - -	509	485	11
June - - -	556	535	8
July - - -	657	636	8
August - -	649	623	13
September -	542	507	22
October - -	542	519	10
November -	465	439	13
December -	462	437	12
1819:			
January - -	377	325	15
February - -	342	295	10
To March -	374	325	12
TOTAL - -	10,117	9,442	281

RETURN, (No. 9.)

Of the Number of Patients discharged cured, and died, in all the different Fever Hospitals of Cork, in the years 1817, 1818, and part of 1819, in montbly periods.

Months'	Fever Hospital and Asylum; discharged.	Died.	Peacock-lane Fever Asylum; discharged.	Died.	GRAND TOTAL:
1817:			1817:		
January - -	140	8	*Note.* - Monthly returns from tbis hospital have not been obtained.		—
February - -	148	8			—
March - -	160	5			—
April - - -	173	6			—
May - - -	221	6	—	—	—
June - - -	229	9	—	—	—
July - - -	190	5	Opened on July 1st.	—	—
August - -	220	7		—	—
September -	324	12	—	—	—
October - -	426	19	—	—	—
November -	322	11	—	—	—
December -	436	20	—	—	—
1818:					
January - -	422	23	—	—	—
February - -	458	18	—	—	—
March - - -	561	17	—	—	—
April - - -	571	16	—	—	—
May - - -	718	19	—	—	—
June - - -	754	13	—	—	—
July - - -	906	14	2,783	102	—

(*continued*)

I.
MUNSTER,

Return, (No. 9.)—Fever Hospitals, Cork—*continued.*

Months.	Fever Hospital and Asylum; discharged.	Died.	Peacock-lane Fever Asylum; discharged.	Died.	GRAND TOTAL.
1818:			Closed on the 24th		
August - -	924	21	528	10	—
September -	695	34	—	—	—
October - -	725	17	—	—	—
November -	710	24	—	—	—
December -	636	21	—	—	—
1819:					
January - -	459	23	—	—	—
February - -	401	13	—	—	—
March - - -	325	12	—	—	—
TOTAL - -	12,254	401	3,311	112	16,078

RETURN, (No. 10.)

From the South Fever Asylum, in *Cork.*

Date.	Patients admitted.	Discharged cured.	Died.
1817:			
December -	195	78	9
1818:			
January - -	139	121	10
February - -	137	138	7
March - -	165	171	5
April - - -	204	177	12
May - - -	212	233	8
June - - -	251	219	5
July - - -	282	270	6
August - -	264	301	8
September -	207	188	12
October - -	234	206	7
November -	215	271	11
December -	204	199	9
1819:			
January - -	167	134	8
February - -	138	106	3
TOTAL - -	3,014	2,812	120

This hospital is now closed.

I.
MUNSTER.

RETURN, (No. 11.)

Of Patients relieved from the Dispensary at *Cork*.

Date.	Patients admitted.	Of these, were Patients in Fever.
1817:		
January - - - -	542	108
February - - -	482	121
March - - - -	530	100
April - - - -	626	213
May - - - -	776	359
June - - - -	795	475
July - - - - -	781	420
August - - - -	734	480
September - - -	822	554
October - - - -	1,077	635
November - - -	1,055	649
December - - -	1,003	639
1818:		
January - - - -	1,101	849
February - - -	989	685
March - - - -	1,116	740
April - - - -	1,143	682
May - - - - -	1,311	866
June - - - - -	1,593	1,108
July - - - - -	1,781	1,203
August - - - -	1,710	1,173
September - - -	1,513	1,015
October - - - -	1,325	889
November - - -	1,109	697
December - - -	931	573
TOTAL - -	24,841	15,233

The greater number of the above fever patients, were sent to hospitals.

RETURN, (No. 12.)

From the Peacock-lane Fever Asylum, in *Cork*.

From July 1st 1817, to July 1st 1818.

Number of Persons admitted - - - - - -		3,013
Sent home cured - - - - - -	2,783	
Died - - - - - - -	102	
At present in the Asylum - - - -	128	
		3,013

From the 1st July to 24th August, when the house was closed -	528
Died of this latter number - - - - - - - -	10

RETURN, (No. 13.)

From the Fever Hospital at *Bandon*, County of Cork.

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
From March 13th	14	11	3
April - - -	21	20	1
May - - - -	48	46	2
June - - - -	109	105	4
July - - - -	268	260	8
August - - -	150	144	6
September - -	190	180	10
October - - -	132	116	16
November - -	72	66	6
December - -	69	68	1
1819:			
January - - -	68	60	4
To Feb. 28th -	37	10	1
TOTAL - -	1,178	1,086	62

In the hospital on the 1st of March, 27 patients.
Total number of beds, 49.
Number of beds vacant, 22.

RETURN, (No. 14.)

From the Dispensary and Fever Hospital, *Fermoy*, County of Cork.

In the year 1817, received the benefits of the Dispensary and Fever Hospital;

Interns - - - - - -	105
Externs - - - - - -	980
Total - - - -	1,085

In the year 1818:

Interns - - - - - -	346
Externs - - - - - -	1,000
Total - - - -	1,346

In June last the number of fever patients amounted to 101; of these 42 were intern, the remainder extern patients.

Temporary hospitals were erected; but on December 31st 1818, it was reported that the patients in the hospital were - - - - 14

In extra house - - - - - - - -	4
Extern - - - - - - - - -	25
Total - - - - - -	43

Showing a great decline; and this has been progressive.

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I
MUNSTER.

RETURN, (No. 15.)

From the Fever Hospital at *Mallow*, County of Cork.

Date.	Patients admitted.	Discharged cured.	Died.
1817:			
From June -	15	6	—
July - - -	21	10	—
August - -	54	30	4
September -	87	74	3
October - -	56	60	4
November -	48	53	2
December -	56	53	2
1818:			
January - -	77	61	2
February - -	69	50	3
March - -	50	45	14
April - - -	65	65	4
May - - -	84	56	16
June - - -	81	78	11
July - - -	79	75	8
August - -	78	78	8
September -	94	82	8
October - -	91	89	5
November -	48	48	6
December -	50	64	5
1819:			
January - -	47	35	2
To February -	37	48	2
TOTAL - -	1,287	1,160	109

The number of bedsteads in this hospital amounted to 45.
The number of patients in the hospital, 17 only, on the 4th of March last.

RETURN, (No. 16.)

From the Fever Hospital at *Killarney*, in the County of Kerry.

Date.	Patients admitted.	Discharged cured.	Died.
1817:			
July - - -	48	47	1
August - -	46	46	—
September -	50	50	—
October - -	41	40	1
November -	47	47	—
December -	64	62	2
1818:			
January - -	98	95	3
February - -	87	86	1
March - -	86	83	3
April - - -	70	69	1

(continued)

I.
MUNSTER.

Return, (No. 16.)—Fever Hospital at Killarney—*continued.*

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
May - - -	135	134	1
June - - -	146	144	2
July - - -	97	95	2
August - -	78	78	—
September -	68	68	—
October - -	49	49	—
November -	51	50	1
December -	42	41	1
1819:			
January -	22	21	1
February - -	22	4	1
TOTAL - -	1,347	1,309	21

This hospital contained 21 bedsteads for fever patients; and the total number of patients, including many convalescents, in hospital, amounted to 18.

RETURN, No. 17.

From the Fever Hospital at *Tralee*, County of *Kerry*.

Date.	Patients admitted.	Died.
1817:		
From August 8 to September 8	26	1
October 8 - - -	36	1
November 8 - -	39	2
December 8 - -	40	—
1818:		
January 8 - - -	42	—
February 8 - -	39	—
March 8 - - -	28	—
April 8 - - -	40	1
May 8 - - - -	43	1
June 8 - - - -	56	—
July 8 - - - -	70	—
August 8 - - -	82	—
September 8 - -	66	1
October 8 - - -	61	1
November 8 - -	49	3
December 8 - -	49	2
1819:		
January 8 - - -	37	—
February 8 - -	30	1
March 8 - - -	22	—
TOTAL - -	855	14

The number of beds in the hospital, 24.
The number of patients 10; all convalescent, March 7th 1819.

I.
MUNSTER.

RETURN, (No. 18.)

Of Fever Patients admitted into St. John's Hospital, at Limerick.

Date.	Patients admitted.	Discharged. cured.	Died.
1816:			
August - -	66	66	1
September -	58	44	6
October - -	74	67	3
November -	58	60	3
December -	75	46	7
1817:			
January - -	78	85	1
February - -	110	112	3
March - -	136	106	8
April - - -	175	157	7
May - - -	229	189	24
June - - -	187	191	10
July - - -	265	178	14
August - -	274	251	24
September -	265	276	12
October - -	240	220	20
November -	250	203	23
December -	265	181	25
1818:			
January - -	221	190	49
February - -	196	177	30
March - -	181	175	18
April - - -	194	138	22
May - - -	206	205	20
June - - -	261	281	10
July - - -	387	330	8
August - -	382	385	16
September -	342	338	10
October - -	375	449	13
November -	315	394	10
December -	365	306	11
1819:			
January - -	203	185	6
February - -	159	165	7
To March 10th	51	51	6
TOTAL - -	6,743	6,201	427

Number of beds, 62.

And number of beds at present occupied, 35.

The use of the military hospital in the square was granted by Government in consequence of the increase of fever; and from the 6th of January to October 6th, 1818, 2,663 patients were admitted to these asylums.

It contained 72 beds and 41 patients, on March 10th 1819; and it was about to be closed at that time.

I.
MUNSTER.

RETURN, (No. 19.)

From the temporary Fever Hospital at Tipperary.

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
February - -	10	4	1
March - - -	16	11	1
April - - -	20	17	1
May - - -	33	22	4
June - - -	21	17	3
July - - -	36	26	5
August - -	25	25	3
September -	15	19	1
October - -	23	15	3
November - -	15	24	3
December - -	19	14	—
1819:			
January - -	3	12	3
TOTAL - -	236	206	28

RETURN, (No. 20.)

From the temporary Fever Hospital at Cashel, County of Tipperary.

Date.	Patients admitted.	Discharged cured.	Died.
1817:			
From July 22d -	14	2	—
August - - -	57	33	2
September - -	42	50	1
October - - -	79	35	—
November - -	19	57	2
December - -	26	36	1
1818:			
January - - -	27	21	1
February - -	17	11	1
March - - -	36	33	2
April - - - -	19	15	8
May - - - -	26	29	6
June - - - -	29	22	4
July - - - -	46	31	7
August - - -	23	32	3
September - -	51	27	---
October - - -	39	50	1
November - -	27	33	4
December - -	14	22	1
1819:			
January - - -	13	7	1
February - - -	17	18	1
To March 13th -	8	2	1
TOTAL - -	629	566	47

The number of beds, 30.

The number of patients, on the 12th of March, only 10; and of these, one-half were in a state of convalescence.

I.
MUNSTER.

RETURN, (No. 21.)

From the Fever Hospital at *Cahir*, County of Tipperary.

Date.	Patients admitted.	Discharged, cured.	Died.
From January 1815, to Jan. 1816 - -	49	49	—
From January 1816, to Jan. 1817 - -	59	57	2
1817:			
January - -	14	14	—
February - -	7	6	1
March - -	—	—	—
April - - -	17	17	—
May - - -	28	26	2
June - - -	12	10	2
July - - -	23	21	2
August - -	33	33	—
September -	35	33	2
October - -	34	33	1
November -	18	17	1
December -	29	29	—
1818:			
January - -	30	28	2
February - -	25	25	—
March - -	36	33	3
April - - -	21	20	1
May - - -	28	28	—
June - - -	54	53	1
July - - -	49	48	1
August - -	35	33	2
September -	51	49	2
October - -	39	38	1
November -	28	28	—
December -	18	17	1
TOTAL - -	772	745	27

REMARK.

The patients were admitted to the hospital during two years, commencing with January 1815, and ending with January 1817, at the rate of from four to five only per month. This hospital contained accommodation for 34 patients. On the 12th March last, there were only two patients in the hospital, both in a convalescent state.

I.
MUNSTER.

RETURN, (No. 22.)

From the temporary Fever Hospital at *Templemore*, County of Tipperary.

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
From September 1st - -	24	23	1
October - -	22	21	1
November -	9	9	—
December -	14	14	—
1819:			
January - -	7	7	—
February - -	9	7	2
To March 20	6	—	—
TOTAL - -	91	81	4

RETURN, (No. 23.)

From the temporary Fever Hospital at *Carrick-on-Suir*, County of Tipperary.

Patients admitted to the temporary hospital, from November 1st 1817 to January 12th 1818 - - - - - - -	45
Admitted from January 12th to May 1st 1818 - - -	200

On May 1st, a more commodious Hospital, fit for the accommodation of 32 Patients, was established.

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
May - - -	45	34	3
June - - -	62	53	—
July - - -	119	110	3
August - -	87	83	1
September -	66	96	4
October - -	79	51	4
November -	80	79	3
December -	56	59	6
1819:			
January - -	29	29	4
February - -	68	47	2
TOTAL - -	961	641	30

I.
MUNSTER.

RETURN, (No. 24.)

From the different Fever Hospitals at *Clonmell,* County of Tipperary.

Date.	Patients admitted.	Discharged cured.	Died.
1818:			
January - February - March -	457	336	17
April - - -	255	234	10
May - - -	218	181	11
June - - -	384	287	22
July - - -	337	304	11
August - -	341	320	25
September -	266	279	21
October - -	158	206	13
November -	156	176	12
December -	88	96	5
1819:			
January - -	69	97	3
February - -	46	57	4
TOTAL - -	2,775	2,603	154

Total number of beds in the hospital at present, 63.

Remaining in the hospital on March 13th, 21 patients and three convalescents.

Fever has never been so little prevalent as at present, since its first invasion epidemically.

II.

MEDICAL INSPECTION OF CONAUGHT;

BY JOHN CRAMPTON, M. D.

During the months of February and March 1819.

Report of Fever in the province of Conaught, including the county of Clare.

County of Galway.

County of Galway.

THE county of Galway is never altogether free from Fever; cases of it are always to be met with in the principal towns; and the villages are never exempt from it.

No district has escaped; where the population has been less condensed, there has been less fever in proportion; and wherever cleanliness and ventilation have been practised, it has died away.

The soldiers were exempt from fever in Galway, Gort, Loughrea and Tuam. This was attributed to their being kept apart from the people of the towns, and from their habits of cleanliness, and attention to the personal comforts of food, clothing and fuel. Fever has not shown itself in the gaol of Galway, nor in the charter school of Monivae; the same attentions have procured immunity to these classes of people. Few amongst the better classes have had fever, but when it has appeared amongst them it has been generally more fatal. The epidemic has been severe and fatal to those who were anxiously engaged in farming or mercantile speculations; and to those whose circumstances were reduced by the fall of lands, and of the price of cattle, and who were thus thrown into embarrassed circumstances; fortunately those classes, from their superior comforts of cleanliness, were, comparatively speaking, exempt; the instances of attacks of fever being rare amongst them.

The epidemic shewed itself early in the southern part of Conaught; this might have been expected, from the condition of the principal towns in the province. The close contracted manner in which the houses are built, the condensed state of the population, together with the total neglect of cleanliness and ventilation, render the occupants peculiarly liable to attacks of contagious fever, which is always resident in the towns where no measures of prevention are taken, and no plan of separation practised under ordinary circumstances.

Fever accordingly showed itself earliest in those towns where the population is most closely collected. It began to excite alarm in Galway, the latter end of summer 1816, and in the neighbouring villages early in 1817. Its appearance in Ballinasloe, Monivae, Loughrea, Gort, Tuam, Headford and Dunmore, was somewhat later than in Galway; it occured in these stations at the same time early in 1817. And there is reason to conclude that the extension of fever was much indebted to the weekly markets, which are much crowded, and where such opportunities were allowed for promiscuous intercourse between the people of the towns and those of the country.

When an epidemic constitution prevailed, Galway was well circumstanced to favour its extension: The streets are narrow and dirty; dunghills and stagnant pools are frequently met with under the staircases of some of the better houses; a separate family lives on each floor, and there is scarcely any rear to them; add to this, that the cellars are filled with poor of the lowest order, and of the most negligent and filthy habits.

There is a village called The Cloddagh, a little to the south-west of the town, on the beach, where the fishermen reside; here fever prevailed much.

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The quay where the fishmarket is held, is in a most offensive condition; immense shoals of fish are there exposed to sale, heaps of them lie on the ground piled up, the offal of them is thrown down; so that a person must literally walk through animal substances in a state of putrefaction, if he wishes to pass in that direction. The stench from this can be perceived all over the town, when the wind blows westerly, which is at least nine months in the year; this is never removed except when the heavy rains wash it away, and thus render the atmosphere more salubrious for a time.

Although there ought to be a good supply of fresh water in Galway, the lake above the town being contracted into a river; yet, from the practice of washing the fish in the river, and the negligence of those who supply the town, the water is taken where the tide comes up and where the fish are washed. Those who drink it, strangers especially, become subject to a bowel complaint; there is reason to suppose that the putrid atmospheric exhalations arising from the fish market, contribute likewise to this.

In other respects Galway may be considered to be healthy, the ground dry and rocky; provisions cheap and plenty for those who can purchase them.

The epidemic from its first appearance in Galway, continued fully two years; its greatest height and mortality were in March 1818; it began to decline in December 1818, and at present fever in Galway is nearly in its ordinary proportion.

The epidemic was at its height, both as to prevalence and mortality, at Ballinasloe in March 1818; at Monivae and Tuam in June 1818; at Loughrea in September 1818, and at Gort in October 1818.

During the continuance of the disease in other parts of the county of Galway, fever prevailed likewise at Ouchterard, and in the extensive districts of Joice country and Conamara. The character of the fever there was generally mild, but still the mortality was considerable, as there was no medical assistance in the country.

The epidemic pressed most generally on the poor or lower orders. Antecedent to its appearance they were in a state of despondency for want of employment, they were unable to purchase food or clothing for their families. The small quantity of sustenance they could procure was of bad quality; wet potatoes and bad oatmeal were the products of the harvests of 1816 and 1817. Whole families were obliged to lie with scarce any covering; they had no fire to cook their scanty fare. After having been exposed to the cold rains of these inclement seasons, they searched the fields for esculent roots; and the Prasha weed in many instances served them for a meal.

Numbers of the poor villagers formed themselves into vagrant hordes, and traversed the country; fever often broke out amongst them: hence they generally carried contagion with them, and often communicated it to those who gave them sustenance and shelter.

Those who were unable to proceed from having been seized with fever, were placed in huts which were built over them, as they chanced to be against a wall or a ditch. They were supplied with water and butter milk by the poor in the vicinity; if there were resident gentry, with porter, wine, gruel and medicines. The mortality was not considerable amongst patients of this description; they were much better circumstanced as to separation and ventilation, than if they were lodged in the inner chamber of a close cabin; and their attendants ran less hazard. For the most part they were placed in public stations, often near a chapel; they were therefore not neglected, being supplied with drink, food and medicine; small contributions of money were also given by those who passed, which were of the utmost service.

The disease was met with mostly in the cellars occupied by the poor in Galway, also in the cabins which compose the suburbs; and in the fishing village which is close to the high-water mark on a dirty strand.

In the suburbs of Loughrea fever prevailed much, also in the mountain villages which are situated on swamps and bogs. Loughrea is much exposed to cold damp winds, which blow across the lake from the south-west; and a considerable quantity of rain falls there, from the vicinity of a mountainous range to the southward, which attracts the clouds.

In Ballinasloe, Loughrea and Tuam, the poor suffered much for want of fuel; the bogs were so overflowed in Summer, that it was impracticable to bring home the turf. Deprived of this comfort, in addition to their other wants, the poor were unable to resist the effects of the inclement seasons: disease therefore naturally ensued.

The character of the disease was the same throughout the whole province, it is the fever which is always to be met with in Ireland; it varied a little in its symptoms, according

CONAUGHT.

according to the seasons: In Winter and Spring the lungs were often affected; in Summer and Autumn the stomach and bowels were frequently disordered; in a great majority of cases the head was much engaged. Spots or petechiæ were very generally present. For the most part, the poor had the fever in a low tedious form; latterly, its type has become shorter; and most of those who appear to have a crisis or favourable change about the 7th or 9th day or earlier, relapse, but ultimately recover. Another change has also been observed within these few months; the fever is more inflammatory, there is more reaction, a higher degree of temperature is evolved; the physicians of the country attribute this last change to the improved stamina of the people, who of late have had food of better quality and in greater abundance.

The means taken to arrest the epidemic in Galway, were judicious and effectual, so far as the physicians were concerned; but they were not sufficiently seconded by the assistance of the people of Galway and its vicinity. A fever hospital was opened in November 1817, and attended gratuitously in turn by the physicians; some of the junior medical men attended the poor at their houses, and in the villages, where they had great difficulties to encounter, in practising ventilation, and in endeavouring to establish habits of improved cleanliness. The hospital was open from November 1817 to 11th August 1818; Government contributed £. 150 to its support. The number of fever cases in August 1818 began to decline, just before the hospital was discontinued, after having given most effectual aid in arresting the progress of the epidemic; most of the poor who had fever in the cellars and suburbs, being removed to the hospital. The impression which the fever hospital made in arresting the epidemic, may be calculated from this, that fever began to decline sooner in Galway as an epidemic, than in any other town in the county; it began to cease in Galway in Autumn 1818; whereas there was no abatement of the disease in Ballinasloe, Tuam, Monivae, Loughrea or Gort, until December 1818. This variation in the time of the disappearance of the epidemic, may fairly be ascribed to the effects of the fever hospital in Galway, whilst no such institution existed in any of the other towns in the county.

In Ballinasloe, and the adjacent district, the poor had the advantage of the active exertion of their landlord, in enforcing cleanliness and ventilation, in the distribution of straw, food and medicines. Ballinasloe is kept cleaner than almost any town in Ireland; the poor are encouraged to practise cleanliness, by annual premiums; and discouraged from allowing dirty habits to prevail, by penalties. Had not such swarms of mendicants passed along the great road which leads through Ballinasloe, it is possible that the epidemic might have been soon extinguished there; especially as the whole district had the advantage of medical aid from the dispensaries of Ballinasloe and Ahercragh, which were in active operation during the whole time of the epidemic. In addition to the money subscribed for these dispensaries, and that contributed by the grand jury, liberal subscriptions were made by the country gentlemen and inhabitants of Ballinasloe, to procure sustenance for the poor.

In Loughrea, meetings of the inhabitants of the town and neighbouring gentry were held; in addition to a liberal grant of £. 130 from Government, money was subscribed and distributed amongst the poor in the suburbs of the town and in the villages; this enabled them to procure food, for which, antecedent to this measure, they were obliged to come into the town, many of them with fever on them, others convalescents, by which means the epidemic had been extended to the shopkeepers.

This distribution of money in small sums, which was done by the physicians who attended gratuitously, and the priests, appeared to be effectual in putting a stop to the progress of fever, by preventing promiscuous intercourse between the villages and the town; an active remedial treatment of the sick, also assisted to subdue the epidemic. Had there been a fever hospital, there is reason to suppose the fever would have subsided earlier. In Loughrea there is a population of above 5,000; the labour therefore of three or four medical men, who attended the poor gratuitously, may be very well calculated.

In Woodford, a village about six miles from Loughrea, there is a dispensary which gave considerable assistance to the poor, and arrested the progress of fever; so that now it has ceased there as an epidemic.

In Gort, about eight months after the visitation of the epidemic, a dispensary was established under the direction of a medical gentleman, who had previously attended the poor in fever gratuitously, both in the town and in the villages; the good effects of this establishment were soon evinced by a gradual diminution of fever.

In Monivae there is a dispensary, the physician attached to which attends the poor in the town and villages.

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In Tuam also there is a dispensary; the physician annexed to this establishment attends the poor in the town and neighbouring district. The progress of the epidemic has been completely arrested by these two very effective institutions.

In parts of the county of Galway, remote from medical aid, the gentry and the Protestant clergy dispensed medicines, and paid village nurses for attending the sick. Food and straw were likewise distributed. The good effects of these measures were very soon conspicuous.

But in the extensive districts of Conamara and Joice country, which are separated from the rest of the county of Galway by Lough Corrib, where there are but few resident gentry, and where the population is scattered over a wild boggy mountainous range, fever prevailed very generally, and still prevails; scarcely any curative measures having been adopted to put a stop to its progress.

Relapses during the earlier periods of the epidemic, whilst the fever continued in a low protracted type, were not often observed, unless in those instances when they were induced by indiscretion, either in taking food too soon, or from premature exposure to cold; but since the *short fever* (as it has been called in the country) has become the prevailing form, relapses are more common amongst all classes of the community.

No particular diseases have been observed to follow the fever in the county of Galway; the general health of those who have passed through the epidemic disease, appear to have been equally good as before they were subjected to the disease.

No doubt is entertained in the county of Galway, as to the contagious nature of the epidemic fever; amongst the lower orders it uniformly extended through every individual of a family where one became affected. It was carried from place to place by the beggars; hence it spread more rapidly in the suburbs of the towns and villages where the mendicants were usually lodged; and this extension of febrile contagion ceased (comparatively speaking) when measures were taken to exclude these hordes of strangers from sojourning in the towns. The disease rarely extended amongst the families of the better classes; cleanliness, ventilation, washing of floors, change of linen and of the sick into separate chambers, always afforded immunity to those who resided in the same house.

Two of the physicians in Galway had fever in a very severe form, and narrowly escaped. Most of the hospital and village nurses had severe attacks of fever: in fine, few of those who were in close attendance on the sick escaped being infected.

In Ballinasloe the fever was equally disposed to spread; it was most rife in the suburbs, to which the mendicants had access: three villages which were out of the line of their march, were less affected with fever. The physician who attends the dispensaries of Ballinasloe and Ahercragh suffered two distinct attacks of fever, but did not relax in his attentions to the poor. All the nurses who were employed to attend the lower orders in the villages, had the fever in their turn.

Fever was equally contagious at Gort and its vicinity; the priest here suffered from fever, which be caught from his attendance on the village-poor, but he recovered.

In Loughrea the medical men and the clergy of both persuasions escaped having the fever, although there was sufficient evidence of its contagious nature, in its general diffusion through the habitations of the lower orders, when one became affected; and from its prevailing most in the suburbs, where the mendicants took up their quarters.

In the other towns and villages in the county of Galway, the fever equally evinced its contagious nature; many priests who were much exposed, and all the village nurses, invariably suffered from the epidemic in their turn.

The disease was equally disposed to spread in the districts of Conamara and Joice country, as already related.

County of Clare.

County of
Clare.

IN the town of Ennis, fever still continues, but in a very inconsiderable degree; there had been a temporary and alarming increase in November 1818; but the epidemic has rapidly decreased since that period. Fever has also declined considerably throughout the whole county of Clare, and may be considered as now very little above the ordinary proportion of fever which is always to be met with in the towns and villages.

The same exemptions as in Galway occurred here. The military, the prisoners in the gaol, and the better orders, all escaped. This was attributed to their superior personal comforts, and to the circumstance of attention having been bestowed on cleanliness, ventilation, and separation from the infected.

Fever had appeared in Ennis early in 1817; it was most severe after the scarcity of the Summer 1817; its fatality however was never very considerable, except amongst those who had not the advantage of medical aid.

The lower classes chiefly affected.

The lower classes were almost exclusively those affected. They had suffered, as they had in the county of Galway, privations of every kind, in food, fuel and clothing; they were dispirited for want of employment; and in the town of Ennis many of them lived in close dirty cellars, the streets narrow, and the population condensed within a small space. The town also had been remarkably dirty and full of nuisances, antecedent to the visitation of the epidemic.

The symptoms of the present disease, are the same as those of the fever which is always to be met with in the towns and villages; it was more severe in 1817: the head at that time was much affected; it has become milder since the stomach and chest have been occasionally attacked. Bowel complaints are at present prevalent (weather cold and damp) but not combined with fever.

The epidemic was combated by the active exertions of a committee, who meet once a week; they have superintended the sweeping and cleansing of the streets and lanes, the removal of nuisances, and white-washing, both in the town and villages. A temporary fever hospital was fitted up, on 16th December 1817, with a convalescent ward, in a contiguous building; the hospital was conducted by the gratuitous attendance of five physicians. It is supported by subscription, and by money given by the grand jury, aided by a grant of £.200 from Government. There were only two patients in fever, and a few convalescents in the hospital, at the time of this inspection.

Relapses from fever did occasionally occur; sometimes from cold, sometimes from errors in diet, but they were comparatively few. Recurrence of fever from re-infection, took place when patients returned to their close and ill-ventilated homes, as it was impossible to make them comply with the directions of the committee.

When fever occurred in a house, it invariably extended through the whole family amongst the lower orders; one medical man had fever, but recovered. It seemed most disposed to spread in Spring and Summer 1818; it did not extend to the upper classes.

Throughout almost the whole of the county of Roscommon, the epidemic was severely felt. It prevailed in Athlone, Roscommon, Strokestown and Boyle; also at Elphin, Tulsk, Castlerea, and Mount Talbot; at present it has nearly disappeared. In Athlone there are still a few fever cases, and Strokestown is not altogether exempt from it. But Roscommon and Boyle, where it was most general at one period, are now altogether free from the epidemic.

In the vicinity of all these towns, the dry rocky grounds were more exempt from fever than the morasses, boggy and mountainous districts; in the former description of places, the crops were of better quality, and the potatoes dryer.

The military and the upper classes escaped fever generally, throughout the whole county. Their exemption is attributed to their superior comforts, as to their habitations, food, clothing, and fuel, and their habits of cleanliness; as well as to practising separation when fever did occur. In the town of Roscommon, however, an exception to this occurred. Fever appeared amongst the soldiers at one period, but it was soon got under. It showed itself afterwards in the Charter School; 39 children having passed through the fever, one of whom died.

In most of the towns and villages in the county of Roscommon, the epidemic appeared early in the year 1817: it showed itself a little later at Boyle, there it prevailed very generally. At Roscommon, Elphin and Strokestown, its greatest prevalence and mortality were from June to September 1817; at Boyle, in October 1817; at Athlone, in February 1818.

The average mortality amongst the lower orders who had medical attendance, was computed to be about one in thirty.

Many causes conspired to injure the bodily health, as well as depress the mind, amongst the middling and lower orders, which thus subjected them to attacks of fever. The bad quality of the food, which disagreed with the stomach and bowels, the scarcity of provisions, want of fuel to cook their meals, and to protect the lower orders from cold and damp. The breaking of the provincial Bank, which affected the middling and lower orders, produced a general despondency; also, the want of employment occasioned by the scarcity of money.

Under these circumstances, almost every individual who went to work or who used the slightest exertion, was seized with shivering, and fever immediately

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followed; those also who were most exposed to wet and cold, experienced the same ill consequences.

Among the better classes, many of those who were affected with fever had sustained severe losses, either by the failure of the Tuam Bank, or by the fall on the prices of land and stock. The final issue of a considerable proportion of such cases was unfavourable.

The epidemic was the ordinary fever usually to be met with in Ireland, but it was modified according to the season and to circumstances; at first it was a low fever, which ran out to several days, the head being much engaged; in the Summer and Autumn, the stomach and bowels were affected; in Winter and Spring, the lungs. In January 1818, the fever became more inflammatory, and it has since shortened in its period, or number of days. This short fever generally terminates by profuse perspiration, within nine days at furthest; often so early as the 5th or 6th day.

In Athlone, the poor had medical aid from a dispensary; small subscriptions were made and food distributed to the poor. There was also a donation of the Lord Lieutenant's, of £. 50. Whitewashing and fumigation were practised, but the lower orders were very averse to allow such measures to be taken. These measures, although less energetic than what were called for under the severe pressure of the epidemic, and in a town so populous as Athlone, were still effectual in preventing the extension of fever; the small subscription enabled many families to procure subsistence at a time they were unable to support themselves by labour; and the distribution of medicines, under the gratuitous exertions of the physicians, ultimately reduced the proportion of fever cases within the usual limits, always to be met with in a town with so condensed a population as Athlone.

In Roscommon there was more energy; the magistrate, attended by a physician and the priests, went through the town and admonished the people not to harbour the mendicants, or to have any intercourse with them. Constables were stationed to keep them out of the town. The gaol was kept free from fever, by a strict system of separation; no visitors were allowed to go there unless they were inspected by the physician. Large subscriptions of money were collected in aid of the poor; food also was distributed. This relief was limited to two parishes, in order to prevent promiscuous intercourse and to exclude strangers. Ventilation and whitewashing were practised as far as could be done. Some districts were unprovided with medical aid; for instance, between Roscommon and Dunmore, from Roscommon to Athlone, from Roscommon to Castlerea: the mortality in these districts was more considerable.

In Boyle, in addition to £. 40 advanced by Government, subscriptions were also made; a soup kitchen was opened in the town in June 1817. Houses were ventilated and whitewashed, and fumigation was attempted; but this latter measure could not be managed with effect in the dirty cabins of the poor. A dispensary afforded very effective medical aid to the poor, under the direction of the clergyman, and the active exertion of three or four medical attendants.

Where many lay in fever in the same house, separation was effected by placing some of them in outhouses; and in many instances temporary huts were erected for their accommodation; so that the epidemic appeared to be ultimately subdued by perseverance in these active and well-concerted measures.

In Strokestown where there is no dispensary, little exertion was made to put down the fever. Food, money and medicines were supplied by charitable individuals in the vicinity; and an apothecary gave his gratuitous assistance. Fever still lingers there.

At Elphin there is a dispensary, from whence all the sick poor within three miles of the town are attended; the whole expense of this, including a salary to the physician, is paid by the bishop.

This establishment contributed to arrest the progress of the epidemic, by giving medical assistance to the poor in fever, and by pointing out those who were fit objects for further relief.

At the time fever was most pressing, the bishop opened a fever hospital at Elphin, and supported it at his own expense until the death of Dr. Feeney (who died of fever,) at this time there was only one patient in the hospital; the epidemic therefore at Elphin, may be fairly said to be put down by the judicious and energetic measures that were put in practice.

Dispensaries are also established at Castlerea, Tulsk, and Mount Talbot; these establishments gave considerable aid in subduing the epidemic in their respective districts.

Relapses were frequent during the whole course of the epidemic, especially since the

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the fever has become shorter in its period; the relapses are attributed by the country physicians, to want of proper treatment during the convalescence of the poor, and to too early exposure to cold, damp and fatigue. Re-infections have also occurred occasionally; for the poor having few changes of clothes, and from living in crowded cabins, where whole families have been ill of fever.

Few diseases have been the result of the fever. In some few instances, temporary dropsy has appeared in persons advanced in life, and symptoms threatening consumption have been observed in younger subjects; but in neither cases have these occurrences proved fatal.

The epidemic invariably spread through every individual of a family, when one became infected, amongst the lower orders; it was less disposed to do so amongst the better classes, on account of their improved state as to ventilation and cleanliness, and the facility of separation in different chambers.

In Athlone, the fever appeared to be most disposed to extend itself in the months of July, August, and September 1817. None of the medical attendants died from fever; although some of the assistants, the junior especially, had the disease in a mild form.

In Roscommon, this disposition to spread was much observable in June 1817. The medical attendants of Elphin and Ballimoe caught the fever, and died from it. At Strokestown, the apothecary's son and daughter had it; here the disease appeared to be extensively disseminated by hordes of mendicants coming into the town and occupying lodgings in it.

In Boyne, fever spread rapidly; its general diffusion, which was in Autumn 1816, was increased by serving soup to the poor in the town; this attracted crowds, who were obliged to wait a considerable time exposed to cold and wet; the convalescents from fever having unrestricted intercourse with those who were well. The contagious return of the fever in Boyle was fully evinced by the foregoing fact. Two of the medical men had fever in a mild form; and the clergyman's son suffered from it in a severe and protracted form.

County of Mayo.

County of Mayo.

IN the county of Mayo the epidemic fever was much felt; it prevailed in Balinrobe, Hollymount, Westport, Newport, Castlebar, Killala, and Ballina; the mountainous district of Erris was also severely afflicted. It is very much on the decline in all the places mentioned; indeed, as an epidemic, it may be considered as almost extinct, with the exception of Killala, where there is rather more fever than in ordinary seasons; and in the district of Erris, where there is no medical assistance.

The same exemption occurred in Mayo as in Galway and Roscommon; the better classes, the military, and the prisoners in the gaols escaped fever: they were supposed to derive their immunity from having enjoyed the comforts of better food, better clothing, and abundance of fuel.

The dry rocky districts had less fever than those bordering upon the boggy mountainous places. In the former the potatoes were comparatively speaking dry, and the other crops of a better quality, and the inhabitants less exposed to cold and heavy rains.

Ballinrobe and Castlebar were less pressed by fever than Hollymount and Kilmain. In Westport, Killala and Ballina, the epidemic was still more severely felt; these last stations are much exposed, and a vast quantity of rain falls at all seasons of the year. The appearance of the epidemic fever did not attract notice so early in the county of Mayo, as in those of Galway and Roscommon, with the exception of Galway and Ballina; there, fever cases were observed in September and October 1816. In the other towns of Mayo its appearance was considerably later; it appeared in Balinrobe and Castlebar in June 1817; and in Westport and in Newport not until September and October 1817. Here it was observed, that fever sooner rose to its height as to prevalence and mortality, than at those places where it broke out earlier; fever at Westport was at its height in December 1817; whereas in Balinrobe and Castlebar its greatest prevalence was in March 1818; and in Killala and Ballina not until December 1818.

No accurate account could be obtained, as to the time of the first appearance of the epidemic in Erris; fever, however, has prevailed there to a great extent in the scattered population in that mountainous district, and the mortality has been considerable.

The lower orders throughout the whole county of Mayo, had suffered great privations; they were deficient in the material comforts of food, clothing and fuel; the potatoes were wet and bad, the crops had been unproductive; they were much subjected to the influence of cold and rain, which falls in unusual quantities in that country,

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country, part of which is bounded by a high mountainous range, and part exposed to the sea. The poor were in a state of despondency for want of employment; and the middling classes equally so, from the fall of lands and of the prices of stock.

Most of the towns in Mayo are negligently kept, dunghills and other nuisances allowed in the streets, and the population rather condensed for the size of them; more attention is paid to Westport, which looks cleaner. Westport is however exposed to the western blast from the sea, and on every other side surrounded by a boggy mountainous range, which furnishes damp and attracts the rain; the situation therefore cannot be considered salubrious.

Killala is in a very dirty state, although the town is small and stands high, as well as exposed to the sea.

Ballina is a close thickly inhabited town; it was very negligently kept until the epidemic appeared, since that time more attention has been bestowed on it.

The character of the fever has been the same throughout, and does not differ from that usually to be met with in Ireland. It has varied in symptoms with the season; in cold weather the lungs have been attacked; in warm weather the stomach and bowels; and at all seasons the head has been much engaged: latterly, the fever has been milder in its symptoms and of shorter duration. The change for the better first occurred in Westport, in April 1818; in Castlebar, in June 1818; in Ballina, in September 1818; and in Killala, December 1818.

In Ballinrobe, Cong, Hollymount and Kilmain, the cases have been milder since Summer 1818.

Exertions in Mayo, to arrest progress of the Epidemic.

Considerable exertions were made to arrest the progress of the epidemic, in almost every town in Mayo, both by the medical practitioners and the neighbouring gentry; and it may be observed, that in those towns and districts where most exertions were made, there the fever soonest subsided. This is fully exemplified by Westport and Castlebar, in which town there are fever hospitals; accordingly there the fever soonest subsided. Although fever appeared late in Westport, it very soon arrived at its acme; its sudden subsidence may be fairly attributed to the salutary influence of an excellent fever hospital, and a good system of cleansing, ventilating, and purifying the houses, giving employment to the poor, and supplying them with food. Westport appears much indebted to the liberality of its resident landlord, who contributed largely to the support of a fever hospital, which was assisted also by a liberal grant from Government, of £.200.

In addition to opening a fever hospital at Castlebar, contributions in money were also made by the gentry residing about the town; the streets were swept, dunghills removed; bread, porter, oatmeal and sugar were distributed to the sick poor; the decisive influence of these measures in putting down the fever, were very soon evinced in Castlebar and its vicinity.

The poor were humanely attended at their homes, and huts built for them where the sick were too much crowded, in Hollymount, Kilmain and Ballinrobe. Subscriptions were raised about Hollymount for supplying the poor with food; this measure, by keeping them at their homes, prevented the fever from spreading as much as it otherwise might have done. Independent of the efforts of the medical men, much was done by the Protestant clergy. They distributed straw and medicines in many parts of their parishes, with the best effects.

In Killala there is a dispensary; patients were attended at their homes from this institution. The bishop also employs a medical man for his own tenantry; a considerable number were attended also by him. The bishop distributed money and food among his own tenantry, and gave them employment. The epidemic was much checked by these measures; but as there was but little co-operation in the neighbouring gentry, and as the town is kept in an offensive filthy state, fever still lingers in Killala, where it appeared at least as early as any other town in Conaught.

In Ballina, although there was neither a fever hospital or a dispensary, considerable efforts were made. Ventilation, whitewashing, and fumigations were practised, nuisances removed, the streets and lanes regularly swept, large contributions in money were collected, straw distributed to the poor; soup, meal, and other food supplied; the sick were attended at their homes, and medicines dispensed to them.

Under these judicious and humane measures, the fever declined in Autumn 1818, and has not recurred in any formidable degree since.

Relapses in fever have been frequent, especially of late, since the short fever has become the prevailing form of the epidemic; this has been observed at Killala, and seems to promise a speedy extinction to the fever there.

Other diseases rarely followed the fever, in those who were previously of a sound constitution.

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constitution. Dropsy in a few instances was observed in old subjects who had been intemperate; and some of the younger were threatened with consumption.

The contagious character of the epidemic was evinced, by its extending itself through every family amongst the lower orders, when one became affected; amongst the better classes this did not occur; ventilation appeared to diminish the power of the contagion, and separation into another chamber afforded perfect security in an airy house. An advantage attended placing the poor in huts, as this was in point of fact a mode of separation; and if their clothes were washed and ventilated, the convalescents did not disseminate the fever, under cautious management. Mendicants occasionally extended the contagion, but there were fewer of them in Mayo than in the line of the leading roads through Galway and Roscommon. In Ballinrobe no medical men had fever. In Westport and Newport, the apothecary of each place had it in a severe form. In Castlebar the medical men escaped; the same fortunate exemption prevailed in Killala and Ballina. In the vicinity of all these places the village nurses who attended the poor in their homes, and in some instances the strangers in their huts, invariably took fever of some period. No clergyman or priest died of fever in Mayo, though some of them were infected.

The counties of Sligo and Leitrim have experienced the pressure of the epidemic, at least with as much severity as any of the other counties of the Conaught district; it has been more felt by the lower orders; the more comfortable classes have had it in a very reduced ratio. Happily at present, as an epidemic, fever may be said to be almost extinct; cases of it are, however, always to be met with in so populous a town as Sligo, and the country villages are never altogether free from it.

The villages of Mobirow, Grange and Drumcliffe suffered still more than the town of Sligo. Fever prevailed also extensively at Carrick-on-Shannon, and still more so at Mohill, but now fever cases are rare in Carrick and its vicinity; it still prevails in some of the villages in the county of Leitrim.

The chief exemptions from fever, in addition to the better classes, were the gaols of Sligo and Carrick, which though unusually crowded, were kept free by separation, and attention to diet, ventilation and cleanliness. The Charter school of Sligo, and the infirmaries both of Sligo and Carrick, escaped fever; similar precautions having been taken.

In Sligo and Leitrim the epidemic appeared early in the year 1817. In the town of Sligo it was general, it was not confined to the lower orders; many of the middling classes and of the higher took the fever; and amongst those latter description the mortality was more considerable. In Carrick-on-Shannon the fever was equally pressing; and in the district of Mohill its severity was still more felt than at Carrick.

The prevalence of fever in the county of Sligo, was greatest from September 1817 to March 1818; the mortality was also most considerable between those periods; since that time, however, it has gradually declined.

In Leitrim, fever was most prevalent from June to the latter end of October 1817; it abated in March 1818, but was again renewed in July, and continued until Christmas, as may be seen by the monthly returns.

The same remarks are applicable to the lower orders in Sligo and Leitrim, as to the other counties of the Conaught district. Despondency, want of employment, want of food, of fuel and of clothing, reduced their moral and physical powers so low, that they became ready subjects for fever on the application of the slightest occasional causes. The degree of exposure to wet and cold, to which the Irish are well accustomed, and which seldom proves injurious to them under ordinary circumstances, scarcely ever failed in these years of distress to bring on shivering, which was invariably succeeded by fever. Towards the beginning of the Winter 1818, the epidemic began to decline, and it has been decreasing ever since.

The fever assumed the same characters in these northern counties of Conaught, as it had in the others. It became milder within the last six months, and less fatal latterly. It was called The *short Fever:* for in the early periods of the epidemic the disease ran out for two or three weeks; whereas from five to nine days was often the utmost extent of this new form, with this peculiarity, that relapses were often the consequence.

Admirable Dispositions in Sligo to meet the pressure of the Epidemic.

Admirable dispositions were made in Sligo, to meet the severe pressure of the epidemic, both by the physicians and the inhabitants of the town, when the cases became too numerous for the physicians to attend at their homes. Four district medical inspectors were appointed in Spring 1817. The physicians, assisted by those active medical officers, were enabled to extend their aid not only to the town, but to the neighbouring villages. A fever hospital was opened in September 1817, which experience has proved to be fully equal to provide for the poor in and about Sligo;

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£.400 was granted by Government, and subscriptions to the amount of £.1,500 were collected; the streets and lanes were swept, nuisances removed, the houses ventilated and whitewashed; in addition to this, sustenance was distributed to those who required it. The result of these combined measures was, as might have been expected, a considerable diminution of fever; and under a perseverance in the same well-concerted measures, it has continued to decrease until the present time, when it may be considered nearly extinct as an epidemic.

In the county of Leitrim, little was done to arrest the progress of the epidemic, except those measures which emanated from the medical practitioners. There is no fever hospital in Carrick or in the county of Leitrim; the poor, however, had medicine distributed to them from the county infirmary, and were attended at their homes as far as the other avocations of the medical attendant of the county infirmary would permit it. He attended also to another district seven miles distant from Carrick; and had notices put up in the town, recommending the most effectual steps to be taken for the suppression of the epidemic: under his direction, also, cabins were cleansed, whitewashed and ventilated.

There is no magistrate in the town, or within two miles of Carrick; no further means in addition to those already mentioned were taken, except that a subscription was entered into to supply the indigent with both broth and meal during the Summer, and until the harvest should be collected.

In the district of Mohill, where the fever pressed with unusual severity, much was done by the active operation of a dispensary, which afforded effectual aid to a very considerable number of fever patients. This institution was assisted by a grant of £.70 from Government, and by subscriptions from the resident gentlemen in the country. During seven months 1,957 patients got relief from this establishment; and though the dispensary is now closed for want of funds, yet it is pleasing to observe that fever has nearly ceased in that quarter; which is in a great measure to be attributed to the exertions of that institution, to cleansing and whitewashing the cabins, and occasionally separating the sick, placing them in outhouses and in huts, and supplying them with the kind of nourishment adapted to their situation. Relapses were very frequent, both in the counties of Sligo and Leitrim, more especially within the last six months. According to the observation of the physicians at Sligo, a great majority of their patients, both among the lower orders as well as in the higher classes, relapsed since the *short fever* has become the prevailing form of the disease. They were unable to assign any particular cause for this change in the period and form of the epidemic.

No particular diseases were observed to follow as consequences to the epidemical fever. In many instances it was surprising to see how soon and how completely the health of the sufferers was re-established, especially if suitable nutriment had been afforded in their convalescence.

In some instances a protracted state of debility was the result; and in those who were predisposed to constitutional diseases, fever frequently proved the means of eliciting the predominant morbid affection.

The contagious nature of the epidemic was fully evinced in the counties of Sligo and Leitrim; it invariably spread from one member of a family through the whole circle, amongst the lower orders, where separation could not well be practised, until the fever hospital became established. One physician (Dr. Ferguson) died. One of the district inspectors likewise fell a victim to the epidemic; the three other inspectors had the fever in a severe form, and scarcely any of the apothecaries escaped being infected by the disease.

In Carrick the epidemic was equally disposed to spread; and in Mohill and its vicinity fever was perhaps more general than in any part of the Conaught district. Here however the beneficial efforts of a dispensary, aided by a liberal grant from Government, of £.70, and the exertions of the gentry of the country, were observable; insomuch so, that the disease began to decline in Winter 1818, and is now nearly extinct as an epidemic. Had not a salutary check been given to the progress of the disease in these two counties, by the effective institutions already mentioned, it is possible that fever would have extended itself more generally, and have presented obstacles to its removal, which might have proved quite insuperable.

RECAPITULATION.

FROM the preceding details, it appears that Fever is always to be met with in the western district of Ireland, in the towns, in the villages, and amongst the scattered population throughout the country; but no remarkable increase of fever cases attracted

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attracted notice until the latter end of the year 1816, or the beginning of 1817: fever then appeared nearly at the same time, at every distant point of the western district. No doubt fever was on the increase before the period assigned, in several places; but it is curious to observe how closely the reports from every station agree as to the time of the commencement of the epidemic. From the period it attracted attention, its progress continued for about two years; and there has been very little abatement of it until within a few months antecedent to the time this inspection was made. Happily, throughout the whole province, fever is now considerably on the decline; the cases are less numerous, the disease itself is milder in its symptoms, and shorter in its duration; indeed, in a great majority of the towns and villages in Conaught, as well as in the county of Clare, there is not more than the ordinary proportion of fever cases to be met with, so that as an epidemic the disease may be said to be at an end throughout the whole of the western district.

There were no places in Conaught, which derived an exemption from fever, from their local situation. Almost the whole of Conaught is of a dry limestone formation, the ground uneven, broken by hills and valleys, well watered, and interspersed with lakes; under ordinary circumstances the country is wholesome, and no particular diseases are endemic. It should be observed, that bog forms no inconsiderable portion of the district, and there is a large share of mountain partly bog and partly rock: There are no noxious exhalations from the latter, either in Summer or Winter; and the inhabitants are equally healthy in their vicinity as in other districts, excepting those instances where their houses are built in too damp situations. In the bogs and mountains the potatoes were worse in 1816 and 1817, than in the dryer soils, and the people were more exposed in getting in their late harvest; this circumstance appeared to affect the health of the inhabitants in no inconsiderable degree.

The classes of people who were, comparatively speaking, exempt from fever, were those who had abundance of good food, who were well supplied with clothing and fuel, who were less exposed to the inclemency of the seasons; and whose minds were at ease, or at least above the feelings of despondency.

The upper classes were therefore more spared; here and there, the father of a family solicitous to provide for his children, and disappointed in his speculations, if he became affected with fever, rarely recovered. Fever, under circumstances of despair and distress of mind, was rarely surmounted amongst the better classes. The military, children in charter schools, the inmates of gaols, almost all escaped. Cleanliness, ventilation, attention to diet, and an early separation of the sick, procured immunity to all those classes from the extension of fever.

The epidemic, as already stated, commenced early in 1817; its greatest mortality was in the Summer of the same year. Some slight variation occurred as to the precise epoch of the greatest increase of fever cases, and mortality in different places; but the time of its being first observed in opposite quarters of the province, affords a curious and interesting proof, that the disease was not imported from without. Its appearance in Sligo, for instance, at the northern, and Ennis at the southern extremity, in Galway at the western, and Athlone at the eastern extreme points of the district, was nearly simultaneous: the same may be said of all the intermediate towns and stations, as appears more clearly in the foregoing detailed account. There is a very slight variation from this statement, with respect to Galway, where the epidemic was said to appear half a year sooner; but fever is always endemic in Galway, and the town itself is peculiarly favourable to the developement and propagation of that disease. The epidemic also attracted notice sooner in Killala and Ballina, than in most other towns in Conaught. These are exposed situations, and an unusual quantity of rain falls in both of them; in these places also, some of the causes which were favourable to the production of disease, were strikingly observable. The epidemic probably was in existence earlier than has been stated, in other places, but it was not observed until it excited alarm by the deaths of some of the better classes; at all events, the exception of three towns does not invalidate the general conclusion as to the time of its appearance, when no precise day or even month can be assigned for its commencement. There appears nothing like a gradual extension of contagion from one station to another, at successive points of time; which would have been the case had the disease been imported, and carried from place to place in the way the Plague is traced in the southern and eastern countries on the Continent.

Fever then, in many instances, would appear to have been produced independent of contagion; in other words, that fever may have a spontaneous origin. That in those who had their constitutions debilitated by want of food, want of fuel, want of clothing, and under the influence of the depressing passions, which might, in the opinion of

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many be considered to constitute the predisposition, such persons readily, if subjected to fatigue, or exposed to wet or cold, became affected with fever. Within the last few years many, after a severe wetting, conceived they had only caught cold, or, perhaps, that symptoms of inflammation of the lungs were most obvious. Such cases however, after a few days, could not be distinguished from the ordinary form of the epidemic fever; and though such patients had clearly contracted their diseases independent of contagion, yet they were found capable of communicating a similar disease to others. This observation is consonant to the experience of most of the intelligent practitioners in the different principal towns, who conceived that the fever had two distinct sources; one *spontaneous*, arising from the condition of the poor, and the peculiar circumstances of the seasons; the other from contagion: that in both instances the disease was equally communicable from one person to another.

The lower orders were almost the only sufferers from fever, in the first instance; they were precisely under those circumstances which rendered them highly predisposed to disease; so that it only required that any of the usual exciting or occasional causes of fever should be applied, to ensure a full developement of the epidemic. They were feeble for want of sufficient sustenance to enable them to work; they often wanted food, they searched the fields for roots and herbs; the potatoes were bad and unwholesome; they were chilled for want of comfortable clothing or fuel; they were dispirited and desponding for want of employment. All these circumstances exhausted their constitutions, and destroyed the proper and harmonious balance of the circulation, which should ensue health; it only required that they should undergo some slight exertion, or be exposed to cold, and fever inevitably followed such exertion or exposure. Accordingly the labourers were observed at their work, to droop and become faint, to fall into shivering and profuse sweats, which mostly ended in fever. The wet Summers both of 1816 and 1817, thus completed the constitutional injuries in this class of the community.

The general despondency was much heightened in the county of Roscommon and Galway, by the failure of a country Bank; a general bankruptcy among the middling shopkeepers, and insolvency amongst the lower orders, was the result of this. The better classes were thus disabled from giving employment to the poor; and the poor, unable to pay their rents, quitted their tenures, or were ejected from them, and assembled in wandering hordes. Fever broke out amongst them from the privations they suffered, and from their necessary exposure to wet and cold; and they disseminated it wherever they went. Many of these wandering tribes were hospitably entertained with food and shelter, by the proprietors of the land; and in many instances fever was thus communicated to the better classes; and wherever it did occur, the mortality was much higher than with the poor, amongst whom the fever was much milder. The question of the greatest moment is, however, a consideration of the means the most appropriate to meet and arrest the visitation of an epidemic, such as that already described. In many of the towns, from the preceding detail, it is evident that much was done in mitigating its severity, in providing accommodation, medicines, food and other comforts for the sufferers; in practising whitewashing, ventilation and separation, by removing the poor to huts, barns and hospitals. Fever certainly ceased soonest to press on those stations where these means were best put in practice; and had there been no other source of fever but that of extension of contagion from one individual to another, or from infected clothes and furniture, the curative and preventive means would have sooner shown their efficiency in putting down the epidemic. But notwithstanding the active operation of all these well-concerted measures, in diminishing the quantity of contagion and reducing the numbers of the sick, fever was every day still showing itself; fresh cases occured in detached situations, from causes over which human means could have no direct or immediate control. In fact, it was not until the stamina and constitutions of the lower classes became improved and recruited by the plentiful harvest of 1818, that these spontaneously-produced fevers ceased to show themselves. The means resorted to and put in practice, were probably the best that the exigency of circumstances permitted; and they were successful, so far as it was reasonable to expect; and had they not been resorted to, the country would have been in a state very little short of Plague.

It may be observed, however, that in some towns, notwithstanding the disinterested activity of the physicians, and the ready assistance afforded by Government wherever it was necessary, that little was done by the inhabitants or neighbouring residents of the country. Collections of money were certainly made, whenever the evil was of sufficient magnitude to threaten their own establishments; but again, when it was less pressing, the subscriptions fell off, and there was a remission of that energy and perseverance from which alone any thing decisive could be expected.

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Negligent habits.

On account of those negligent habits, fever is always to be found in some towns; by proper municipal regulations, aided by medical suggestions, this evil might be very much lessened, if not altogether done away. The foregoing detail gives an instructive example of the utility of an active committee who meet weekly, who not only regulate the concerns of the Fever Hospital, but superintend the cleansing and ventilating streets and houses; the result of which is nearly a total cessation of fever in a close town with a considerable population.—(*Vide* Report of Ennis.)

Should an epidemic fever again unhappily visit this country, a fever hospital would be required in every principal town, and a dispensary in the smaller ones. Each physician might be allowed one or more intelligent men, such as hospital serjeants, who could bleed, dress blisters, and assist them in dispensing medicines, and keeping the registers.

Under similar circumstances, the county hospitals which now only accommodate a few chronic patients, of such a description that the greater number of them cannot receive much benefit from medical treatment, might either in whole or in part be converted into fever hospitals until the epidemic had subsided. In the country villages, barns and huts, of which experience has already shown the utility, and in some instances tents might be made the receptacles for the sick, so as to practise separation as soon as possible when fever gets into a family.

Boards of health, and managing committees.

Boards of health and managing committees have invariably rendered important services, wherever they have been established; the public appear to give their subscriptions with more cheerfulness, where committees have been formed. The lower orders also submit more willingly to measures for cleansing and ventilating their dwellings, and to the removal of their sick to hospitals, under the guidance and direction of their landlords and protectors, than under the compulsatory measures of municipal regulation.

The clergy of both persuasions have evinced their zeal and services in the cause of suffering humanity, during the prevalence of the epidemic. The Protestant clergy, as members of committees and as directors of dispensaries, independent of their charitable donations of food, straw and other necessaries. The Catholic clergy have been equally zealous in their personal attendance on the sick, and in assisting the committees and medical attendance, in the distribution of money, food and medicines, through the villages.

The services performed by the physicians (which have been for the most part gratuitous) and of the other medical attendants, cannot well be estimated; as members of boards and committees, their suggestions have been of the utmost benefit; and that their exertions have been attended with imminent personal hazard, has been evinced by the numbers who have caught the disease, and by those who have fallen victims to their professional devotion.

In case of a return of the present epidemic, or of a visitation of a similar nature at a future period, much might be expected from the local knowledge and active habits of these classes of persons.

It is unnecessary to recapitulate facts which go to prove the contagious nature of the late epidemic; its disposition to spread has been universally admitted, and evinced by many circumstances. But it is equally true, that fever in many instances has shown itself from causes independent of contagion, although it has ultimately become capable of being disseminated like that which has evidently taken its origin from an infectious source; but this point has been already sufficiently insisted on in a preceding part of this report.

After what has been said, it requires no minute investigation to assign the principal causes of the late Epidemical visitation; they are to be found in the previous state or condition of the class of people who suffered most from the disease. The circumstances under which they were placed, have been already more than once enumerated. Whenever it shall please Providence, therefore, to afflict a populous country with scarcity of provisions for two successive years; whilst there exist also additional causes to depress the mind and occasion despondency; and moreover, when cold, wet and ungenial seasons are superadded to other causes of distress, an unusual number of Fever cases will be the result in those places, where the population is most dense, and where the habits of the people are most negligent.

John Crampton.

APPENDIX.

GALWAY Fever Hospital:

FROM 29th November 1817, to 11th August 1818;—

Discharged cured	300
Died	9
Total admission	309

BALLINROBE Dispensary:

About 300 families were attended; often 30 houses at the same time.

MONIVAE Dispensary;—for three years:

Fever Cases.

	1816:	1817:	1818:
Cured	44	245	126
Died	3	26	11
Total	47	271	137

TUAM Dispensary:

From 1st June 1817, to 28th February 1819.

MONTHS.	Males.	Females.	TOTAL.	
1817. June	6	4	10	5 Deaths: 3 Men; 2 Women.
July	14	12	26	
August	16	16	32	
September	16	12	28	
October	10	14	24	
November	15	17	32	
December	8	7	15	
1818. January	7	13	20	
February	4	3	7	
March	8	2	10	
April	5	2	7	
May	5	3	8	2 Deaths: 1 Man; 1 Woman.
June	2	1	3	
July	13	11	24	
August	9	5	14	
September	2	1	3	
October	8	5	13	
November	2	5	7	
December	9	1	10	
1819. January	4	4	8	
February	2	1	3	
21 Months	165	139	304	

LOUGHREA:

No register kept; no hospital; no dispensary; population of Loughrea about 5,000; no computation of fever cases made; 50 severe cases in the Town Close in Summer 1818, at one time.

GORT Dispensary:

About 400 poor attended; deaths 30; no accurate register kept; many not reported until moribund.

ENNIS Fever Hospital.

From 16th December 1817 to 16th March 1818:

1st Quarter	Discharged cured	114	
	Died	4	118

From 16th March to 16th June 1818:

2d Quarter	Discharged cured	92	
	Died	6	98

From 16th June to 16th September 1818:

3d Quarter	Discharged cured	178	
	Died	13	191

From 16th September 1818 to 16th December 1818:

4th Quarter	Discharged cured	103	
	Died	9	112

From 16th December 1818 to 23d February 1819:

Discharged cured	17	
Died	1	
In Hospital	8	26

Total admissions	545
Total deaths	33

ATHLONE Dispensary:

Numbers attended at their homes in Athlone and its vicinity, and supplied with medicine from the dispensary.

From 1st July 1817 to 31st August 1818	228
From 31st August to 18th September 1818	27
From 18th September to 12th March 1819	43
	298

BOYLE Dispensary:

September 1st, 1817, under treatment		102
From 1st September 1817 to 31st August 1818		780
Cured	815	
Died	67	882
Remaining in the books 31st August 1818		9

STROKESTOWN:

No fever hospital; no dispensary.

Numbers attended above	300

ROSCOMMON:

No fever hospital; no dispensary; no returns.

Mortality in the county of Roscommon, estimated at 1 in 30.

Ballinrobe, about	170
Hollymount, ,,	200
Kilmaine, ,,	80

were fever; no hospital; no dispensary.

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Fever Hospital, WESTPORT:

From 12th Dec^r 1817 to 12th March 1818	Admitted	-	66
	Cured	56	
	Died	2	
	Remain in hospital	8	66
From 12th March to 12th June 1818	Remain from last	8	
	Since admitted	55	63
	Cured	55	
	Died	2	
	Remain in hospital	6	63
From 12th June to 12th Sept^r 1818	Remain from last	6	
	Since admitted	52	58
	Cured	51	
	Died	1	
	Remain in hospital	6	58
From 12th Sept^r to 12th Dec^r 1818	Remain from last	6	
	Since admitted	38	44
	Cured	37	
	Died	1	
	Remain in hospital	6	44
From 12th Dec^r 1818 to 1st March 1819	Remain from last	6	
	Since admitted	20	26
	Cured	22	
	Died	1	
	Remain in hospital	3	26

WESTPORT Extern Patients:

From 12th Dec^r 1817 to 12th June 1818	Number of cases	-	260
	Cured	220	
	Died	3	
	Under care	37	260
	Remaining from last	37	
	Reported since	156	193
	Cured	144	
	Died	3	
	Remain under care	46	193
	Remaining from last	46	
	Since reported	10	56
	Cured	44	
	Under care	12	56

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Fever Hospital, Westport—*continued.*

Total numbers admitted into hospital		231
Total deaths in hospital	7	
Total cured	221	
In hospital 1st March 1819	3	231
Total extern treated		426
,, ,, dead	6	
,, ,, cured	408	
,, ,, under care	12	426
Total number treated both in hospital and extern		657
Total deaths		13

CASTLEBAR Fever Hospital:

Discharged cured	38
Died	3
In hospital	13
Received since the commencement	54

KILLALA Dispensary:

Number attended during two years	306
Deaths	3
Number attended by another gentleman not belonging to the dispensary	300
Total	609

BALLINA:

No hospital; no dispensary; no returns; medical attendants frequently visited from 50 to 100 in a day.

SLIGO Fever Hospital:

From 25 September 1817 to 24th March 1818	Admitted		271
	Cured	213	
	Died	9	
	Remain in hospital	39	271

Remain in hospital	39	
Admitted	221	
		260
Cured	227	
Died	4	
Remain in hospital	29	260

Remain in hospital	29	
Admitted	229	
		258
Cured	215	
Died	13	
Remain in hospital	30	258

Total admissions	789
Total deaths	26

Population of Sligo about 12,000.

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CARRICK-ON-SHANNON:

Population about 1,500.

Number attended in Fever at their homes.

	No.	Died.	Cured		No.		
1817. June	7	1	6	1818. March	5	Cases of persons being 2 or 3 miles distant	256
July	14	-	14	April	4		
August	25	2	23	May	—		
September	11	1	10	June	10		
October	17	1	16	July	33		
November	13	1	12	August	39		
December	9	-	9	September	14		
1818. January	12	-	12	October	33		
February	14	-	14	November	—		
				December	23		
Within the above period there occurred amongst the military	7	1	6	1819. January	11		
				February	4		
In thecounty gaol	15	1	14	March	4		
TOTAL	144	8	136	TOTAL	180	deaths 5.	

		144
		210
		180
		256
Registered cases in fever applying for medicine within the same period	210	
	Total of cases	790

Besides in a parish, 7 miles distant - - 156 families.

MOHILL Dispensary:

Number treated for fever from August 29, 1817, to March 28, 1818		1,957
	Deaths	53

III.

MEDICAL INSPECTION OF THE PROVINCE OF ULSTER;

During the Months of February and March 1819:

By Dr. James Clarke.

County of Down.

County of Down.

IN this county the epidemic seems to have totally subsided; a few cases of fever are to be met with in particular situations, such as will ever occur so long as the habits of the lower orders remain unchanged.

The late epidemic first appeared in this county about the month of October one thousand eight hundred and sixteen, in the vicinity of Downpatrick, and became general in the Spring and Summer following, with the exception of the small town of Rosstrevor.

The circumstances to which the inhabitants owe their exemption, appear to be as follow: The town is out of the common thoroughfare, situated in a remarkably dry soil, with wide and airy streets, devoid of those miserable habitations where the lower orders of travellers and mendicants are lodged; and it is a fact acknowledged by every one, that they were the great importers of infection throughout the country in general. The town is much resorted to in Summer by sea bathers and other visitors, who circulate a great deal of money among the inhabitants, who are thereby induced to keep their houses clean and in good order. Large contributions were made by the neighbouring gentry, during the scarcity in one thousand eight hundred and sixteen, for the purpose of purchasing provisions, clothing, and fuel for the poor, which may be brought forward as an additional reason why they should have escaped an evil so prevalent in the surrounding country. Generally speaking, the epidemic appears to have been at its acmé, as to prevalence and malignity, from the month of July one thousand eight hundred and seventeen, until the month of March one thousand eight hundred and eighteen, from which period it has gradually subsided.

Previous to its appearance, the poor laboured under the greatest privations, proceeding from want of employment, great scarcity and bad quality of provisions, which naturally produced great despondency of mind. Such was the bad quality of the flour, that peasants were frequently known to go a distance of thirty miles to procure bran or pollard, to enable them to make it into bread.

The scarcity of fuel was also severely felt; in many instances they were obliged to eat their provisions raw; and for weeks together during the winter months, their clothes were hardly ever dry.

From the concurrent testimonies of medical men, it does not appear that the epidemic differed materially from the ordinary fever of the country; nor did it vary much in character during its prevalence, except that during the latter periods the symptoms became milder, more tractable, and of shorter duration.

No class of society were wholly exempt from its attacks; with the poor it was most general, but among the higher orders more fatal.

The mortality among the former seldom exceeding one in twenty, while among the latter it amounted to one in five.

On the other hand, wherever it appeared in a poor man's house, scarcely an individual escaped the infection; not having it in their power, unless in the vicinity of an hospital, to separate the person infected from those in health, nor of adopting the necessary measures of cleansing and ventilation. Among the poor, relapses were very frequent, particularly so in the latter periods of the existence of the epidemic, and instances of recurrence of the disease were often observed: some individuals had it three times. Among the better class, relapse was not so frequent; and a second individual in their families being attacked with the disease, was hardly ever known.

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Those who have recovered from it do not appear to have suffered any constitutional injury; their convalescence, generally speaking, was complete.

The means adopted throughout the county to prevent the spread of the disease, were nearly the same, and their success proportionate to the energy with which they were carried into effect. In the mountainous districts, where they received no assistance or medical advice, the mortality is reported to have been excessive; and in such towns as did not establish fever hospital or board of health, scarcely a house escaped the contagion, while in others not more than one in four were visited by the disease.

Early separation of the affected.

Early separation of the infected from those in health; cleansing, whitewashing, and ventilating the apartments from which they were removed; and endeavouring, as far as possible, to exclude mendicants, were the usual means resorted to. But it is much to be regretted, that to procure the co-operation of the poor, was a matter of almost insuperable difficulty. In some instances, the people sent to cleanse their dwellings were refused admission and maltreated; and the sick, though convinced of the contagious nature of the disease, were, in the commencement of the epidemic, very unwilling to go into hospital. This prejudice was almost totally overcome by the pressure of the evil; and the confidence of the poor, in the benefit conferred on them by such establishments, is now universally felt and acknowledged.

In the neighbourhood of Briansford, a family in comfortable circumstances, who took every precaution to avoid the possibility of infection, are firmly persuaded that the fever was introduced among them by a web of linen, which was wove for them by a family, some of whom laboured under fever. What adds strong presumptive proof to their opinion, is, that the two individuals who were employed in preparing the web for the bleach-green, were the first who were affected, and took ill on the same day. The fever hospital accommodation for this county did not exceed sixty beds.

County of Antrim.

County of
Antrim.

IN this county the epidemic did not commence at so early a period as in the county of Down; the first cases were observed about July one thousand eight hundred and seventeen, in the vicinity of Belfast and Lisburn; many places which subsequently suffered severely, were not visited by it until September or October following.

The only district which escaped the disease, was the island of Raghlin; the proprietor of which took the greatest pains to prevent the contagion being imported from the main land, by cutting off all communication as far as possible, and by an accurate examination of those who landed.

In the year one thousand eight hundred and fourteen, a very severe fever appeared in the island, which, there is every reason to suppose, was imported by some of the inhabitants who went to Scotland to see one of their relations who died of fever; they brought his clothes home, and shortly after the fever made its appearance and spread through two or three neighbouring families. From this circumstance they were particularly alive to the danger of infection, and their insular situation enabled them to avoid it.

The epidemic has almost totally declined in this county. In the suburbs of the town of Belfast, and in mountainous or marshy districts where it raged with the greatest violence, a few cases are still to be met with, but they are not malignant, and are declining in number every day. A circumstance appears worthy of remark, that the better class of people in this county suffered, comparatively speaking, little or nothing from the fever; the number affected, and the comparative mortality, were not by any means so great as in the neighbouring counties: this many of the inhabitants are inclined to attribute to the more prompt and extensive hospital accommodation afforded to the poor in fever. The hospitals of Belfast, Lisburn, and Randalstown, contained nearly three hundred patients.

It was remarked to me, that a district of four townlands in the vicinity of Randalstown, the inhabitants of which were noted for their industry, cleanliness, and comfort, exceeding what is ordinarily to be met with in Ireland, escaped the epidemic until a late period, when it appeared after they had inadvertently given lodging to some mendicants.

In some houses, the inhabitants of which were remarkable for their poverty, the disease seems to have taken such deep root, that for nearly two years they were never entirely free from it.

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In every other respect, the circumstances of this county so accurately coincide with those already mentioned in the Report of the county of Down that I think it unnecessary to repeat them.

County of Armagh; February.

County of Armagh.

NO epidemic here at present, and few cases of fever to be met with.

About the month of June 1817, it was first observed, that the epidemic had taken root in the towns of Armagh and Lurgan, and was most prevalent and fatal from that period until the following Spring. In this county the only circumstance I can point out, differing from what has been already stated, is, the extraordinary prevalence and mortality of the disease among the better class of society in the town of Armagh. To account for this is matter of great difficulty; I shall therefore merely state a few facts, and leave it to the judgment of others how far they may have influenced the disease. In the winter of 1816 and 17, when the poor were suffering under misery and privations of every description, owing to the scarcity and bad quality of provisions and fuel, soup shops were established for their relief, with the most humane and benevolent intentions.

This collected an immense crowd of mendicants, and poor of all descriptions, into the town, who horded together in miserable lodging houses, lying on the floor on straw; and, in many instances, taking up their quarters in the market-house, or any place where they could procure shelter.

No Board of health.

No board of health was formed; and the fever hospital which they attempted to establish, was on so very limited a scale, and open for so short a period, that wherever fever appeared, having no means of removing the infected from those in health, it uniformly spread with the most fatal rapidity.

The town is thickly inhabited, and the houses of the lower orders are very numerous.

I did not hear of any district in this county, which escaped the contagion. A gentleman of fortune and high respectability in this county, is supposed to have contracted the fever from a great coat, which he borrowed from a person in whose family the disease existed.

The fever hospital was capable of receiving 40 patients, 20 of whom were lodged in temporary sheds, and it was open only 5 months; during which period one hundred and sixty-three patients were admitted, eleven of whom died.

In every other respect, as to the nature of the disease, and the circumstances of the poor, I was unable to discover any variation from what has been already stated.

County of Monaghan.

County of Monaghan.

EPIDEMIC has completely declined, and very few cases of fever to be met with at present.

About May 1817, an increase of fever cases was first observed to such a degree as to excite alarm throughout the county. In the preceding December several cases of fever occurred in the gaol of Monaghan; and it is the opinion of some of the medical men, that from that source it took its origin.

How far the facts will bear them out in this opinion, I am not prepared to say; I believe there is no doubt that the fever which prevailed at that time in the gaol, was conveyed to one or two familes in the neighbourhood, who had some intercourse with its inmates; but it does not appear to have assumed the character of epidemic, until the period beforementioned: nor did its symptoms differ materially from the fevers of the adjoining counties.

Its greatest prevalence and mortality were during the months of July, August, and September; in October it manifestly declined. No district or class of society were exempt from it. Among the lower orders scarcely a house escaped; and where the infected were not speedily removed, it spread rapidly through the family.

Among the better class, hardly any instance occurred of a second person in the house taking the disease; nor was the mortality among them remarkable.

The fever hospital in the vicinity of the town of Monaghan contained fifty beds; but so anxious were the inhabitants to separate the infected from those in health, that, when the pressure was great, they put two patients into each bed; and during the fourteen months it was open, 1,037 persons were admitted, of whom 51 died.

III. ULSTER.

County of Tyrone.

County of Tyrone.

EPIDEMIC has completely declined in this county.

In the month of July 1817, it appeared universally, and was most prevalent and malignant in the following Winter months.

In the neighbourhood of Strabane, it appears from very accurate returns, that nearly one-fourth of the inhabitants were affected with the disease, of whom somewhat more than the ordinary average died. In the mountainous districts, particularly in the vicinity of Pomeroy, the mortality is reported to have been excessive.

I am inclined to attribute the great prevalence of the disease in this county, to the large portion of mountainous district it contains; the inhabitants of which, in many instances, as soon as they became distressed, quitted their homes, crowded into the towns, and brought filth and infection along with them.

The hospitals of Strabane, Cookstown, and Dungannon, contained 100 beds; a number by no means adequate to the population. In other respects I know of no diversity from what has been already mentioned.

County of Derry.

County of Derry.

NO epidemic here at present; nor has it ever prevailed so extensively as in the counties before mentioned, with the exception of the towns of Newtownlimavady and Londonderry.

It commenced in Londonderry about the month of April 1817, but did not spread through the rest of the county until July or August, and in some places not quite so soon.

In the town of Magherafelt, great exertions were made to relieve the poor in the Winter of 1816 and 1817; and a large sum of money was expended in procuring them the necessaries of life; and here, in particular, the epidemic never raged to any great extent.

In Newtownlimavady a soup shop was established, which collected an immense crowd of poor in the town. In Londonderry, the fever prevailed principally in the suburbs, which are extensive, and situated in a low damp situation.

Temporary booths were erected in the vicinity of the town; and during the prevalence of epidemic, six hundred and thirty-six fever patients were admitted, thirty-five of whom died.

Counties of Donegal, Fermanagh, and Cavan.

Counties of Donegal, Fermanagh, and Cavan.

IN these three counties, from the best information I could procure, the epidemic was not near so prevalent as in other parts of the province. It appeared among them about the commencement of the Summer of one thousand eight hundred and seventeen, but neither the number affected, nor the mortality were so great as in the other districts. This may partly be ascribed to their not being so much in the thoroughfare of the great tide of labourers travelling towards Scotland and England, in the Summer months, by whose means, there is reason to think, the contagion was spread in the towns to a great degree. Their fever establishments, consequently, were few, and the numbers received very limited. In the towns of Cavan and Enniskillen small hospitals were opened, but on a limited scale; and it was not found necessary to enlarge them. In the county of Donegal, I did not hear of any fever hospitals whatever.

In the mountainous districts, as before remarked, the cases were more numerous, particularly in that part of Donegal called Innishowen. At present there is as little fever as ever was known throughout this district of country.

From the foregoing statement it appears, that the province of Ulster was affected very generally with epidemic fever, from the Spring of one thousand eight hundred and seventeen till the Summer of one thousand eight hundred and eighteen. From that period it has gradually declined; and at present it may fairly be stated as reduced to its ordinary standard, and no longer to exist as epidemic.

In its nature it does not appear to have differed materially from the usual fever of the country, and perhaps may be considered as a mere extension of it; to which the following circumstances highly contributed.

The unusual quantity of rain which fell in the Autumn of one thousand eight hundred and sixteen, rendered provisions deficient in quantity and quality.

It also deprived the poor of their usual supply of fuel, which they were unable to remove from the bogs where it was cut. These privations, combined with want of employment, produced a great depression of spirits, under which they became highly susceptible of receiving the contagion of fever. There is great reason to apprehend that this predisposition to fever, will exist more or less, till the habits and manners of living of the lower orders be radically changed.

As a proof of the foregoing statement it may be adduced, that the poor were uniformly the greatest sufferers; and it seemed to rage among them, in a degree proportionate to the privations they had endured.

In the mountainous districts, with no resident gentry, and the inhabitants left to their own resources, and where the crops actually rotted in the fields, the prevalence and mortality of the disease appear to have been very great; whereas the better classes, the military and public institutions, comparatively speaking, suffered little or nothing.

That the disease was highly contagious, wherever ventilation and cleanliness were not resorted to, appears from the universal spread of it among the families of the poor; and from the number of clergy, medical, and other attendants on the sick, who were affected by it.

That it was possible to convey it by means of clothes, bedding, &c. is not doubted by the most competent judges I had occasion to meet; and there are but few who are not prepared to relate numerous and well authenticated instances, to support their opinion.

The extreme difficulty of eradicating the disease from the dwellings of the poor, and the manner in which it seems to have been disseminated over the country by the lower order of travellers, and mendicants, appear to me conclusive on this point.

With respect to preventive measures, little can be added to those which have been resorted to already, with so much benefit to the country at large, and so much credit to those whose wisdom and liberality contributed eminently to carry them into effect; and I am happy to add, so gratefully and universally acknowledged.

It is to be hoped, that the present system of education, carried on so generally through the country, will, in time, produce such a reformation in the habits of the people as will ultimately eradicate the evil.

After a year of scarcity in particular, endeavouring as far as practicable, to supply the poor with employment, food and medical assistance, so as to prevent the spread of fever among them, seems highly requisite. Wherever these measures were adopted with energy and activity, the result was highly favourable; but I should recommend great caution to be observed in the mode of putting them into effect, as it appears the establishment of soup shops in towns was frequently attended with injurious consequences. It is obvious, therefore, that in affording assistance, every measure, tending to collect them in crowds, should be avoided as far as possible.

In many instances, the boards of health found great difficulty in procuring the co-operation of the poor; therefore some sort of medical police might be attached to them, whose duty it should be, to enforce the necessary measures of cleansing, ventilating, and removing nuisances.

Where it is found necessary to establish a temporary fever hospital, confining the medical attendants to one or two, excites jealousies and ill-will; it would, therefore, be preferable to give each respectable practitioner a share in the public duty: from which I have no doubt great benefit would ensue to such institutions, and to the public in general. And as, in some instances, the first appearance of the epidemic has been observed in gaols, such establishments should be provided with an appropriate apartment, to which contagious or doubtful cases should be instantly removed.

It is to be regretted, that the county hospitals which in general are large and commodious, have no provision whatever for patients labouring under contagious diseases. Some change, either in the construction or management of such institutions, is very desirable.

Recommendation of boards of health.

I would earnestly recommend, that the Boards of Health should continue for some time longer to exert their useful measures of cleansing, ventilating, and removing nuisances; as it is not improbable that, during the heat of the ensuing Summer, some increase of the number of fever cases may take place, so [illegible] once more to give rise to the idea, that epidemic again prevails.

And I have no doubt that any measure suggested by Government, to the resident gentry, clergy, and medical men of the province, will be instantly attended to, as they have universally appeared most anxious to adopt every practicable means likely to mitigate the misery of the poor, or to benefit the country at large.

James Clarke.

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APPENDIX.

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ULSTER.

Monthly Report of the Fever Hospital in Newry; from its commencement, 12th July 1817, to the 18th February 1819, inclusive.

Months.	Admitted.	Died of Fever.	Died of Diseases supervening Fever.	Discharged Cured.	Remained in Hospital at the end of each Month.	Total N° receiving Medical Aid.
1817.						
From 12th to 31st July	61	—	—	35	26	61
August - -	99	5	2	80	38	125
September - -	116	1	—	103	50	154
October - -	106	4	3	105	44	156
November - -	102	4	—	101	41	146
December - -	86	7	1	83	36	127
1818. January -	75	2	6	67	42	111
February - -	64	2	2	66	36	106
March - -	76	3	—	76	33	112
April - - -	72	2	1	68	34	105
May - - -	94	1	1	86	40	128
June - - -	91	—	—	90	41	131
July - - -	150	2	—	136	53	191
August - -	101	2	2	95	55	154
September - -	49	2	—	67	35	104
October - -	46	1	—	63	27	91
November - -	42	—	—	44	25	69
December - -	34	2	1	37	19	59
1819. January -	17	1	1	15	19	36
February 18th. -	13	—	2	18	12	32
	1,494	41	16	1,435	706	2,198

Received from Government the sum of - - - - - - -		£. 350.
D°	the Grand Juries of the counties of Down and Armagh -	175.
D°	by Subscriptions from the town of Newry - - -	765.

Monthly Report of the Belfast Fever Hospital.

Months.	Admitted.	Died.	Dismissed.
1817. August - -	73	—	73
September - - -	164	6	158
October - - -	201	9	192
November - - -	200	9	191
December - - -	228	17	211
1818. January - -	193	14	179
February - - -	142	11	131
March - - -	152	16	136
April - -	139	8	131
May - - - -	79	7	72
June - - -	90	4	86
July - - - -	125	6	119
August - - -	112	6	106
September - - -	138	7	131
October - - -	174	5	169
November - - -	148	10	138
December - - -	114	7	107
1819. January - -	65	4	61
Total - - -	2,537	146	2,391

III. ULSTER.

A Monthly Report of the Fever Hospital in LISBURN; from the 7th of June 1816, to the 7th of February 1819.

----	Admitted.	Dismissed.	Died.
From 7th June to 7th July - -	23	12	—
- 7th July to 7th August -	24	10	—
- 7th Aug^{t} to 7th Sept^{r} - -	26	9	—
- 7th Sept^{r} to 7th Oct^{r} - -	26	13	—
- 7th Oct^{r} to 7th Nov^{r} -	24	10	1
- 7th Nov^{r} to 7th Dec^{r} -	16	7	2
- 7th Dec^{r} to 7th Jan^{y} -	25	6	3
- 7th Jan^{y} to 7th Feb^{y} -	24	8	2
- 7th Feb^{y} to 7th March -	29	9	3
- 7th March to 7th April -	25	5	2
- 7th April to 7th May -	25	7	2
- 7th May to 7th June - -	20	8	3
- 7th June to 7th July - -	16	10	—
- 7th July to 7th Aug^{t} - -	24	8	2
- 7th Aug^{t} to 7th Sept^{r} -	26	10	2
- 7th Sept^{r} to 7th Oct^{r} - -	27	8	2
- 7th Oct^{r} to 7th Nov^{r} -	18	10	—
- 7th Nov^{r} to 7th Dec^{r} -	20	9	—
- 7th Dec^{r} to 7th Jan^{y} - -	19	6	—
- 7th Jan^{y} to 7th Feb^{y} - -	23	8	—
	469	173	24

Note.—In this Return and some of the succeeding, all of which are accurate Copies from those delivered to me from the several Fever Hospitals, there is an error in the Dismissals; the Statement of Admissions and Deaths I believe to be correct.

James Clarke.

Monthly Report of the RANDALSTOWN Fever Hospital; from 3d October 1817, to 14th December 1818, inclusive.

Months.	Admitted.	Discharged	Died.	Total.	Observations.
1817. October -	45	13	1	14	During this period there was three hundred out patients, most of them labouring under Typhus.
- November -	41	29	2	31	
- December -	31	33	4	37	
1818. January -	12	11	2	13	
- February -	19	26	1	27	
- March -	13	18	—	18	
- April -	3	16	—	16	
- May - -	42	9	—	9	
- June - -	25	20	2	22	
- July - -	24	41	1	42	
- August -	22	23	1	24	
- September -	10	12	1	13	
- October -	8	12	1	13	
- November -	4	14	—	14	
- December -	—	6	—	6	
	299	283	16	299	

III.
ULSTER.

An accurate Monthly Return of the number admitted, discharged, and died in the Fever Hospital at Armagh; from its commencement, October 1st, A.D. 1817, to its closure in February 1818.

Month.	Admitted.	Discharged cured.	Died.	Remarks.
October - -	52	21	3	One of those who died this month was a child of three weeks old; another was sent in a dying state; and the other was asthmatic.
November - -	50	37	7	One of them died of hemucheye from the intestines; another, a child of five years, died of suffocation from immense glandular swellings in the neck; the majority of them had typhus gravior.
December - -	13	31	1	
1818. January -	5	19	—	
February - -	1	1	—	
Total -	121	109	11	
Re-opened 9th September 1818.				The disease at this time was much milder; the majority having typhus miten, but a good many cases of typhus gravin.
September - -	42	16	—	
October - -	—	26	—	
	42	42	—	

Report of Monaghan Fever Hospital; commencing August 16th, 1817.

Months.	Admitted.	Discharged.	Died.	In Hospital.
August - -	159	89	3	67
September - -	100	74	13	80
October - -	98	100	5	73
November - -	81	86	5	63
December - -	78	68	2	71
January - -	75	84	2	60
February - -	80	59	1	80
March - -	29	86	6	15
April - - -	9	12	2	52
May - - -	76	32	2	10
June - - -	54	32	4	30
July - - -	129	112	4	103
August - -	60	104	2	57
September - -	9	44	—	20
	1,037	964	51	—

III. ULSTER.

COOKSTOWN Fever Hospital.

Months.	Admitted.	Discharged.	Dead.	In Hospital.
1817. October - -	46	27	3	16
- November -	34	35	2	13
- December -	24	22	1	14
1818. January - -	30	36	1	7
- February - -	18	15	1	9
- March - -	16	25	—	—
TOTAL - -	168	160	8	—

KILDRESS Fever Hospital.

Months.	Admitted.	Discharged.	Dead.	In Hospital.
1817. October - -	38	25	2	11
- November -	50	42	3	16
- December -	31	37	2	8
1818. January - -	29	24	8	13
- February - -	23	23	1	12
- March - -	19	31	—	—
TOTAL - -	190	182	8	—

From the 1st of September 1817, till the 31st of August 1818, there were 1,112 extern patients prescribed for in Typhus, of whom 28 died.

A Return of Fever Patients accommodated in the temporary Hospital DUNGANNON, between 1st July 1817, and 1st February 1818, when it closed.

Months.	Admitted.	Discharged.	Died.	Remarks.
July - - -	19	16	—	
August - -	24	19	2	
September - -	38	31	2	
October - -	50	64	3	
November - -	36	41	1	Child not of Fever.
December - -	25	21	1	Child not of Fever.
January - -	19	19	—	
	211	211	9	

Note.—1,663 extern patients treated, supplied, &c. during the above period. 26 Beds.

III.
ULSTER.

A General Report of the STRABANE Fever Hospital.

Month.	Admitted.	Discharged	Died.
1817. August - - -	90	37	—
September - -	71	69	3
October - - -	80	96	5
November - -	67	71	2
December - -	62	50	2
1818. January - - -	44	46	1
February - -	14	22	1
March - - -	12	19	1
April - - -	17	16	—
May - - - -	7	12	1
June - - - -	18	12	1
July - - - -	24	20	1
August - - -	13	17	1
September - -	16	18	—
October - - -	16	16	—
November - -	8	12	—
December - -	10	10	—
1819. January - - -	8	11	1
February - -	8	6	1
TOTAL - -	585	560	21

Remaining in Hospital, March 13, 1819 - - - 4

IV.

MEDICAL INSPECTION OF THE PROVINCE OF LEINSTER;

performed in February and March 1819: by Dr. Cheyne.

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N. B.—The Figures (1 to 9) relate to the heads of Inquiry which were agreed upon by the Inspectors, before they set out on their respective Tours:

1. - - - Relates to the present state of the Epidemic.
2. - - - The Class of people which have suffered most by it.
3. - - - The time of its first Appearance, and greatest Spread and Mortality.
4. - - - The State of the Community when it first appeared.
5. - - - The character of the Disease.
6. - - - Preventive means.
7. - - - Relapse and recurrence.
8. - - - Permanent Effects of the disease on the Constitution.
9. - - - Its Infectiousness.

Wicklow and Wexford.

Counties of Wicklow and Wexford.

1. IT is a common opinion, that the Fever which of late prevailed so extensively, originated in the Winter of 1816 or succeeding Spring; but my inquiries in the counties of Wicklow and Wexford have led to a different conclusion. In some parts of the county of Wicklow, as for example, in the neighbourhood of Stratford-on-Slaney, fever of the same general character with the present, was more frequent and fatal four years ago than it has been since; and it was universally admitted, by every one acquainted with the condition of the poor, that fever is never altogether absent; that at all times there are cases of it to be met with in every populous or extensive district.

In Wicklow the epidemic was abating; but in Wexford, where it had never prevailed to the same extent, after an appearance of decline in November, it was again rather increasing about the time of my inspection.

2. Fever had existed among the labouring poor in most parts of these two counties; there were some cases among the farmers; and here and there a case occurred in the upper ranks.

IV. LEINSTER.

In some parts of Wicklow I found it difficult to ascertain the period at which fever became epidemic; but it was pretty generally considered as commencing in the end of Summer 1817, and was at its height about the end of that year and beginning of 3. 1818. In Wexford no considerable increase of fever took place before the Summer or Autumn of 1818, and the epidemic was at its height in that county in September and October 1818; many bad died in Wicklow during the height of the epidemic, but in Wexford the mortality had been inconsiderable.

4. In the county of Wicklow the disease had been most prevalent among the wretched peasantry in the mountains, in a tract commencing above Newtown-mount-Kennedy, and extending to Tullow in the county of Carlow. But it is observable, that at Rathdrum, which is the centre of that range, I was credibly informed that the same disease was as prevalent in 1816, as at the time of my visit. In the county of Wexford it prevailed in the back lanes of the towns; for example, in the suburb of the town of Wexford, called John's-street, where the houses are ruinous and extremely filthy; and where I understand there are always some cases of fever to be met with.

4. Although the inhabitants of these places, at first sight, may appear differently circumstanced, there were many points in which they resembled each other, when fever began to rage among them. They were equally cut off from all communication with the upper ranks of society. In some of the mountain parishes, Hacketstown for instance, on the borders of Carlow, there is not a resident gentlemen but the rector; yet I am persuaded, that the inhabitants of the bye lanes of the towns have as little intercourse with their superiors in rank, as the inhabitants of these remote districts.

The state of the poor when the epidemic appeared, was worse than ever it had been known, in consequence of a succession of bad seasons: in Wexford, at the period of my inspection, it was still very bad. In some places not one half of the labouring poor had employment; many of the farmers had discharged all the labourers they were wont to employ: and few, if any, retained the usual number. At an average potatoes were 5*d.* per stone, labourers' wages about 10*d.* a day without food; and it is computed that a labourer at his three meals will consume a stone of potatoes daily. Turf in most places was uncommonly dear. The clothes of the poor were nearly worn out, and many of them slept in their body-clothes for want of blankets. Depressed in strength and spirits, they were thrown open to the disease which every where existed among them; and which it was generally thought was propagated not merely from one neighbour to another, but by the swarms of beggars who overran the country: and it is well known that, from motives of mistaken charity, beggars are never refused admission into the cabin of the labourer, or the house of the farmer. From Dublin to Gorey, I heard complaints of the injury which the country had sustained from the beggars, who were banished from Dublin last season by the Mendicity association. Many of these wanderers actually laboured under fever, and others probably conveyed contagion from house to house in their clothes; and contagion when so conveyed, is generally supposed to be more active and injurious than when it proceeds from the persons of the infected. This, which is an important consideration in the prevention of fever, may be practically illustrated by the following occurrence which took place in the neighbourhood of Gorey, under the eye of a respectable physician of that town, just before fever became epidemic. A beggar from Limerick obtained admission into a labourer's cabin for herself and a dying child. In five days after she quitted the cabin, fever took place in one of the family, which consisted of the man, his wife and five children; and in succession within a day or two of each other every individual sickened; and two children from a neighbouring cabin who had attended the child's wake, took the same fever within ten days thereafter, and communicated it to their family. The beggar (herself in good health) went to a farmer's house two miles off, and obtained a lodging the night after her child was buried; every individual in that family, a man, his wife, two children and a servant, also took the fever within a few days: these fevers were all severe.

In the parish of Delgany, county of Wicklow, the small farmers and labourers who refused admission to beggars, and who ceased to frequent wakes, escaped the fever, while others of the same class suffered; and some months after a fever bad gone through a family in the Wicklow mountains, it was frequently re-introduced by beggars from Dublin.

It is remarkable, that the great increase of fever cases was observed in most parts of the county of Wicklow, in the latter end of the summer of 1817, when there was every reason to expect a second unproductive harvest; while in Wexford it was not

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observed until the latter end of 1818, which, if we suppose the disease influenced by scarcity of provisions, may perhaps be explained in the following manner. Wexford being almost entirely a tillage county and requiring a great deal of rain, suffered less by the wet seasons of 1816 and 1817 than any county in Ireland. In the Spring and Summer of 1818, the epidemic could scarcely be said to have extended to Wexford; it certainly prevailed at New Ross on the borders of the county of Waterford; but its existence at that time was not acknowledged by practitioners of medicine in the towns of Enniscorthy, Wexford and Newtown Barry. But the drought of that year caused a very short crop; and consequently the food of the poor, though of a very good quality, for the last five or six months has been both scarce and dear. In the town of Wexford I found potatoes at 7*d.* and 8*d.* a stone; and I understood, while in Tullow, in the county of Carlow, that every market day there were eight or ten cars sent thither from the county of Wexford for potatoes, which were sold at 4*d.* a stone in Tullow.

In many places both in Wexford and Wicklow, an increase of fever cases was observed to follow any diminution of employment; and it was in this way that many intelligent persons accounted for the more frequent occurrence of fever at the period of my inspection, which took place at the *dead* season of the year.

5. The disease, which in the county of Wicklow was at first severe, and often fatal, did not, at the time of my visit, differ from the ordinary continued fever of the country, unless in being milder and shorter; even under the most unfavourable circumstances of hospital accommodation, and under very opposite methods of treatment, during the last eight or nine months the patients almost all recovered. The hospital of Hacketstown was an unfloored room in a waste house from 16 to 18 feet square, unventilated save by the door, chimney, and a hole in the thatch; and so dark that I could not count the patients, who, twenty-seven in number, lay on straw spread on the ground, generally two under one blanket, and crowded so, that there was no perceptible space between them. Yet, out of two hundred fever patients, who had been in this hospital within a few months, not one had died; and notwithstanding the extreme poverty of the inhabitants, and the want of every comfort but fuel, not more than 5 or 6 persons had died of fever in that parish during a period of six months.

In the fever hospitals of the counties of Wicklow and Wexford which I visited, I saw probably two hundred sick, of whom not more than eight or ten appeared to be severely ill, and not more than 3 or 4 of these dangerously; of the latter I rather think all, with one exception, would recover. A physician in Enniscorthy where, by the way, it was in contemplation to establish a board of health, assured me that he had seen only one instance of the Typhus Gravior since May. I found only one corpse in these hospitals; and in the course of five days travelling I met only one funeral, and that of a person who died of jaundice. The disease was more fatal in the towns than in the country, and among those who underwent fever in their own cabins than among such as went into hospital; yet probably not one in forty died even of the former, during the last eight months. Among the farmers and the higher classes the mortality was heavy, probably about one in three, in all beyond the age of twenty-five.

The disease, which on its first appearance in the county of Wicklow, extended at an average to fourteen days, had of late, in a great majority of cases, terminated in five.

6. In all the towns which I visited in these counties, means had been taken to restrain the progress of fever; the upper classes raised subscriptions and formed committees for the relief of the poor; these committees obtained prompt assistance from Government, without which their benevolent intentions could not have been carried into effect. Fever hospitals were established, and many of the indigent sick were attended at home; in some places money and in others provisions were given to convalescents. In certain districts, as for instance at Rathdrum, inspectors were sent round to detect disease; the sick were conveyed to the hospital, their bedding and furniture were washed, their cabins fumigated and lime-washed, and provided with windows; and constables were stationed on the highways to drive away beggars. These measures seemed to restrain, but they did not suppress the disease.

The injury done by beggars was evident to every observing person. Finger posts were put up in several places, warning them off; and several Catholic clergymen from the altar, denounced the practice of harbouring them. At Baltinglass a board of health was established in December 1818, under the Act of last Session; this board,

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whose meetings were held once a fortnight, appointed inspectors, circulated printed instructions among the poor, caused the sick to be removed to hospital without delay, their cabins to be whitewashed, their furniture washed, their clothes and bedding disinfected, lending them blankets in the mean while; and at the time of my visit to Baltinglass and Stratford-on-Slaney, they were deliberating on the best means of excluding from their district of nine parishes, all strolling beggars and vagrants. Their plan however was not perfected, and consequently its effects could not be ascertained; however, it had given them a command of money, at a time when their resources were nearly exhausted, and they seemed to expect from it considerable advantages.

7. The tendency to relapse after the fever, which was not great at first, had become so, and was thought to be in an inverse proportion to the duration of the first attack of fever. The five-day fever was generally succeeded by one or two relapses. Fever had also occurred in the same individual, at distant periods, from the same cause which had at first produced it; namely, from communication with those who laboured under the disease.

8. Judging from observations made in the fever hospitals in Dublin, I was prepared to find the constitutions of many of those who had undergone the disease much injured thereby; but this was by no means the case. It was affirmed by all the practitioners of medicine whom I interrogated, that the fever seldom left any *dreg* of disease behind it; and this was confirmed by the looks of the peasantry, whom I saw at work in the fields: there was nothing in their appearance that indicated disease, discontent, or even poverty, unless that their clothes were generally in a bad state.

9. Although the disease in general was mild and short among the poor, yet it had been productive of great misery, from the disposition it had to spread through families, and from its tendency to relapse. A five-day fever is counted by the poor themselves, more infectious than one of longer duration. When fever once got into a cabin, it infected every individual of the family; and relapses so often occurred, that it was seldom eradicated in less than two or three months: by which many an industrious labourer was ruined. And this was not confined to the poorer parts of the country: in the barony of Forth, one of the most prosperous parts of the county of Wexford, many persons who had lived in comfort were so reduced by prolonged sickness, as to be forced to desert their houses and take to the road as beggars. The fever was supposed highly infectious in the cabins of the poor, but it scarce spread in a house where due attention was paid to ventilation and cleanliness; I heard of only once instance in which it spread through a family in the upper ranks.

Carlow, Kilkenny, Queen's County and Kildare.

Counties of Carlow, Kilkenny, Queen's County and Kildare.

1. IN every town in these four counties, in which my inquiries were made, with one exception, I learnt that fever had existed among the poor long before the present epidemic appeared. I am assured by physicians, who have practised for thirty years in Carlow and Kilkenny, the largest towns in this part of the province, that, during all that time, there has been an uninterrupted succession of cases of fever among the poor, in their respective neighbourhoods. The physician to the fever hospital at Naas affirms, that fever has not been absent from that neighbourhood for 18 years. Portarlington, during 16 years, the period of the senior physician's residence, has never been free from fever. The Roman Catholic clergyman, during 10 years residence in the parish of Tullow, has been called from 40 to 100 times annually, to administer spiritual comforts to persons in fever. It was admitted, however, that fever had, during the last two years, universally prevailed to an extent formerly unknown.

At Castledermot in Carlow, in one or two towns in the Queen's County, in particular at Portarlington, and among the bogs which lie between the towns of Kildare and Rathangan, there were at the time of my visit rather more cases of fever than there had been in December last. In Castledermot the labouring poor were in miserable circumstances. There were, I was told, at least 200 willing labourers without employment out of 500, the wages of the labourer being only 4*d.* a day with food, and potatoes being 3½*d.* a stone; but here, and at Portarlington also, the cases were not by one half so numerous as they were last year at the same season. In the hospital near Portarlington, there were only twenty-seven cases of fever, which, as it accommodated the sick, not merely of the town, but of the populous barony

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barony of Portnehinch, showed no great extent of disease; and as there was no active board of health in that barony, it is probable that the hospital contained many cases which, had they occurred among the poor of a neglected district, would never have been heard of. In every other part of the four counties, fever was sensibly on the decline; there were not more than two or three cases of fever in Maryboro'; in Carlow the physician to the fever hospital considered the epidemic as nearly over; and in Kilkenny there was not more fever than usual at this season.

2. The disease was nearly confined to the poor, among whom fever had prevailed epidemically, during the period above mentioned, in every part of these four counties.

3. A manifest increase of fever cases began to be observed in the Winter of 1816, and ensuing Spring; but in most places fever seems to have become epidemic, about the beginning of Autumn 1817. It was at its height from about the middle of Autumn to the end of the following Winter; at that time also it was most malignant and fatal.

4. Two unproductive seasons in succession had reduced the labouring class to the greatest poverty. Little or no employment could be had by labourers; their clothes were worn out; from the wetness of the weather, turf for fuel could not be saved. Potatoes were wet, scarce and dear. Oats were also scarce and dear. Wheat every where malty; so that when the epidemic began, the poor in many places were living upon weeds. In the neighbourhood of Kilkenny they were feeding on hips, on nettletops and other weeds. Near Stradbally, many families had fed on the tops of the wild turnip*; and at Castledermot this weed (called Prasha Bwee) and a little malty flour, formed the chief articles of nourishment.

5. It is the general opinion, that the disease does not differ from the fever which usually prevails in Ireland. At first there were an unusual number of severe cases, and the fever was in general spotted, but as the epidemic advanced, the cases became milder; and I believe continued fever never was more mild than in the generality of the cases in those parts of the province of Leinster which I have visited: as in Wicklow and Wexford, so in Carlow, Kilkenny, Queen's County and Kildare, it was, in a great majority of instances, a five-day fever, subject to relapses, which scarcely ever occurred in the long fever.

The only place in which the cases were still severe, and the mortality considerable, was Kilkenny; but this I believe arose from dysentery being combined with fever, thereby producing an unmanageable variety of disease.

In the upper ranks the disease has been throughout the epidemic, malignant and fatal.

Means taken by the Poor themselves, to restrain the ravages of Fever.

6. The means taken by the poor themselves to restrain the ravages of fever, ought to be stated. When any individual of a family was affected with fever, the rest sometimes were so much impressed with the danger of contagion, that they had him removed to a barn or out-house (where they had prepared a bed, and broken a hole in the wall to admit of their handing in medicines, and drink) and locked the door, which was not unlocked till some time after the disease was over. This was not a very common practice. But when a stranger, or a labourer who had no cabin of his own, took the disease, it was quite customary to prepare a shed for him by the way side; this was done by inclining some spars or sticks against a wall or bank of a ditch, and covering them with straw. Under these sheds, which the rain penetrated, the patients lay, on a little straw; and cruel though such treatment may appear, it was found by experience that many more in proportion died in the cabins than in the sheds: indeed some medical practitioners thought so favourably of the sheds, that they recommended them to those who might have remained in their cabins.

Committee of Inhabitants.

In most places there were committees of the more respectable inhabitants formed for the suppression of fever; whose chief objects were, early removal of the sick to fever hospitals, whitewashing and cleansing infected houses, furniture, and bed and body clothes, and supplying convalescents with nourishment; and when their funds admitted of it, they also distributed food at a cheap rate to the poor. In many places the operations of the fever committees could not have been carried on, or must have been prematurely discontinued, had they not obtained assistance from Government.

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* Brassica Napus.

Committee at Ballitore.

At Ballitore, a committee of this kind was formed, who explained to the poor, in a series of printed notices, the connection of fever with want of cleanliness and ventilation; instructed them in the most effectual methods of cleansing their houses, furniture, clothes and persons; cautioned them against idly going into infected houses, attending wakes and funerals, and admitting strolling beggars into their houses; and recommended those who had recovered from fever not to go into a neighbour's house, or into any place of public worship for fourteen days thereafter. While they assured the poor that cleanliness and good air would check disease, improve their health and strength, and increase their comforts; they proclaimed to them the maxim which is generally overlooked by charitable associations, namely, that the best directed efforts are unavailing, unless when assisted by the regular and continued exertions of the poor themselves. And acting upon this principle, they declared, that in order to discourage as much as possible that shameful and dangerous disregard of decency and cleanliness, so common among the labouring class, they were unanimously determined only to employ such persons as should keep their cabins clean, whitewashed, provided with a chimney, and with windows hung on hinges, or otherwise capable of admitting fresh air, and the yard or road before their doors free from dunghills or other filth. At Ballitore there was not a case of fever.

At Portarlington I found a board of health, composed of the gentlemen of the neighbourhood, which embraced the whole barony of Portnehinch, and promised to be efficacious, as each member of the board undertook the inspection of the sick on his own property and immediate neighbourhood; taking care to have every case of fever reported to the physicians to the hospital without delay, and that all the necessary measures of disinfection should be practised.

7. Relapses were much more frequent than at the commencement, and during the height of the epidemic, and there were every where instances of the disease having affected the same individual several times; it seemed, however, a general opinion, that persons who had had the disease were less liable to it than others.

8. At Kilkenny the fever had in some instances degenerated into dysentery; but generally speaking, recovery had every where been complete.

9. All ranks and classes of the people believed in the contagion of the epidemic fever; and several instances were related to me, in proof of this opinion, similar to that stated in the report of my first tour of inspection. Thus, in the neighbourhood of Durrow, a woman from Kilkenny, with a sick child, introduced the disease into twelve or fifteen houses, which were her resting places in wandering through that country. Her track for many miles could be traced, by the disease which she left behind her. Near Cuffesborough, in the same neighbourhood, it was introduced by a strolling beggar, in the same manner. The senior physician to the fever hospital at Portnehinch, informed me that the disease occurred in one cottage, five times in the course of twelve months; and during each visitation, almost every individual in the family, inhabiting that cottage, suffered; nor was the disease to be eradicated from amongst them till their cabin was burned. In that neighbourhood five or six cottages were burnt, in order to destroy a latent contagion which resisted all the ordinary means of disinfection.

The nurses and other servants of the different fever hospitals, every where contracted fever, and in many instances the medical attendants also. At Kilkenny the housekeeper, nurses, and most of the servants, had the disease repeatedly during the epidemic; the apothecary and his assistant died of the fever; in short, no person connected with the hospital, escaped, but one of the physicians. It is necessary to state, that the house of industry at Kilkenny had been converted into a fever hospital, for which it was ill suited. The dormitories, which had become fever wards, although clean and cheerful, and not crowded, were not sufficiently ventilated. They had neither chimnies, nor ventilators; and although I have no doubt the windows and doors were generally open, yet this is not enough to secure proper ventilation in a fever ward. It must be admitted, that the disease was contagious in private houses, only when cleanliness and ventilation were neglected or unattainable.

Westmeath, Longford, and King's County.

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Counties of Westmeath, Longford, and King's County.

1. IN these three counties the epidemic was considered as nearly, if not entirely over, with the exception of two places, namely, Edenderry and Longford. 1st. In Edenderry, from the 1st to the 8th of February 1819, both days inclusive, twelve patients in fever had sent to the dispensary for assistance, five of whom resided at a distance of five miles from the town, and the rest at two, three, and four miles distance.* 2. Longford also was represented to me as in an alarming state; I heard that the fever was in the gaol, and was raging among the poor; but, on visiting that town, I found, in the very crowded gaol, only two persons in fever, and six convalescents, the disease being of the mildest kind. The apothecary in Longford declared the town to be as free from fever as he had ever known it, and not more than two fever patients had applied at the dispensary (the records of which I examined) from the 22d of February to the 8th of March. In Longford the disease had prevailed almost universally in the Winter of 1817; and 21 respectable housekeepers, besides many of the poor, had died of it in a short time, when it was at its height.

2. In every part of these three counties, there had been a remarkable increase of fever, with which a few of the gentry, a good many farmers, and the poor generally, had been affected. It appears that Westmeath had suffered less than any county, with the exception of Wexford, which I have yet visited; yet in many parts of Westmeath scarcely a cabin escaped.

3. It is certain that fever had been epidemic in some neglected parts of the country, for a long time before any unusual extent of disease was suspected in Dublin. In the neighbourhood of Philipstown, the epidemic existed among the poor, for a year before it first attracted general notice in that town, in September 1817. In Edenderry in like manner, it commenced in August 1816; in most places, however, it originated in the beginning of Autumn 1817. It soon attained its greatest height, and is supposed to have been most general, and most severe and fatal, in the latter end of that Autumn, and in the Winter and Spring following. In the Summer of 1818, the mortality from the disease greatly abated; since the end of Summer the disease has been progressively declining.

4. In many parts of these counties there was the same deficiency of wholesome food, of good fuel, and of employment, in 1816 and 1817, as in most other parts of Ireland; almost all the poor near Kinnegad fed on *Prasha*, which they boiled and ate with salt, until subscriptions were entered into, and meal, made of beans and wheat ground together, was sold to them at a low rate. And the scarcity of fuel was such, that even on the borders of the bog of Allen, owing to the long continuance of wet weather, there was not a piece of turf fit to be burned. It deserves to be noticed, that during the failure of the common necessaries of life, and general want of employment, the poor conducted themselves with the greatest moderation; there was no clamour nor repining, nor scarce an instance of petty theft.

5. The disease at first was malignant, and generally attended with severe headache and delirium, and spots; but it was considered as differing from the ordinary fever of this country in degree, and not in kind; in Summer it became more mild, and was pretty generally a five-day fever, subject to relapse. Among the poor the disease has been throughout, regular, uniform, and comparatively unattended with danger, requiring no great refinement of treatment; cooling drinks, free air, and purgative medicines, being sufficient to bring it to a favourable issue in 29 cases out of 30. Among the upper ranks, and such as live as the upper ranks do, and have, on the approach of disease, those apprehensions which belong to superior station, the disease has been irregular, complicated, and fatal to one-fourth, or even one-third, under every conceivable treatment.

It is now generally thought that the epidemic has nearly spent itself; but medical practitioners attribute the change in the character of the fever, to the improved condition of the poor. In these three counties I found provisions every where plenty and good; potatoes no where more than 3*d.* a stone; in the county of Longford, 2*d.* or

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* In July 1817, when the fever was rife in the neighbourhood, there were, exclusive of country patients, 80 persons in this small town under the care of the physician to the dispensary.

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or 2¼ d.; and there was nearly as much employment for the poor as they usually have at this season of the year.

The influence of epidemic constitution has been less apparent than might be expected, for the fever every where raged where its predisposing causes subsisted; but as soon as cheerfulness, and a greater portion of bodily vigour were restored by renewed employment and wholesome food, it became milder, and then it gradually disappeared. In Mullengar, Longford, Tullamore, and Philipstown, the principal towns in this tour, although there were still a few cases of fever, the epidemic was considered as nearly over. The month of March furnished the hospital at Parsonstown with only ten cases of fever.

6. In these three counties, as in every other place which I have visited, much has been done for the relief the poor, by subscriptions for the purchase of medicines, wine and food. In Tullamore, the following measures for the suppression of fever were adopted: About the latter end of July 1817, many cases of fever were discovered in the outlets of the town, upon which a board of governors of the King's County Infirmary, assisted by the advice of the physician of the town, established a fever hospital contiguous to the infirmary, to which they removed the infected. Lime was supplied to the poor for whitewashing their houses; nuisances of every kind were removed; all stranger beggars were forced to leave the town, and constables were employed in keeping them away. Finally, inspectors were appointed to examine the suspected houses, which were fumigated and whitewashed with lime freshly slacked; to see that the clothes of the diseased were washed, and their bed clothes exposed to the air, on successive days; that the straw of their beds was burnt, and that they were supplied with fresh straw; to make a return of new cases, as well as report the state of convalescents. These means, doubtless, were highly beneficial, by procuring speedy relief for the sick; and by separating the diseased from the healthy, and disinfecting their houses, the spread of fever was probably checked, but it was not subdued; although as an epidemic it was over, fever was not quite eradicated at the time of my visit, a year and an half after these means of prevention were first adopted.

7. Relapses have been every where frequent since the epidemic began to decline, and they generally follow the short fever; those who have had the fever are considered less liable to it than others.

8. In some few instances the fever was followed by rheumatism, dropsy, and cutaneous eruptions; but persons of a sound constitution have seldom been permanently injured by it. In short, it has not materially deteriorated the constitutions of those who have suffered under it; while it has taught them the value of cleanliness, and the folly and danger of harbouring those idle vagrants who infest the country.

9. Professional men entertain no doubt of the fever being contagious; when the disease was once admitted into a cabin, it generally affected every inmate in succession; to this there was scarcely an exception. In the middling and upper ranks, the medical and clerical visitors of the sick were much more liable to the disease than other persons; all the attendants upon the sick in the hospital of Tullamore had the fever, and two of the nurses died of it. An experienced physician of Parsonstown has known the disease conveyed from an infected mother, by her infant, to the whole family of the hired nurse. So convinced were the poor of the disease being infectious, that their conduct in many places towards itinerants, and in particular itinerant beggars, from being kind and hospitable, had become stern and repulsive; they drove all beggars from their doors, charging them with being the authors of their greatest misfortunes, by spreading disease through the country. The only fact which militates against the contagious nature of the fever, is, its simultaneous appearance in distant parts of the province; but I conceive that this cannot be attributed solely to an epidemic influence, for the seeds of disease were very generally sown, and the causes which promote its growth were every where in active operation.

Upon the activity of the predisposing causes of fever, viz. scarcity of food, and dejection of mind, the early or late appearance of the epidemic seemed chiefly to depend. 1st. When they were in very powerful operation, the epidemic appeared early, the ordinary stock of fever being sufficient quickly to infect the community. 2dly. In places in which they were less operative, disease diffused itself slowly, and the epidemic appeared late. 3dly. Many districts might have escaped altogether, had not the sources of infection been multiplied by diseased itinerants.

Meath and Louth.

Counties of Meath and Louth.

1. IN Drogheda, Dundalk, Kells, and Navan, the epidemic was considered as over; there were not as many cases of fever in these towns as are usually to be met with at this season. The senior physician at Drogheda has known that town for upwards of 30 years, during which time it has never been entirely without fever. In some of the small towns there was not a single patient in fever; this was the case in Collon and Slane; 593 cases of fever were attended by the physician to the Slane dispensary, being the 1st July 1817 and 1st July 1818, and only 45 subsequent to the latter date.

At Ardee, in a space of eight miles square, there was only one case of fever known to the surgeon to the Ardee dispensary; the same practitioner having attended nearly 900 patients in fever between the 20th June 1817 and the 20th June 1818.

2. In these two counties the disease chiefly affected the poor, but it was not confined to them.

3. The epidemic appeared in several parts of the counties of Meath and Louth, in the months of May, June, and July 1817; was at its greatest height in the latter end of that year, at which time it was most fatal also, and began to abate in severity and frequency early in Summer 1818.

4. When the epidemic commenced, the poor were labouring under the greatest distress, in consequence of the want of employment, and the scarcity of fuel and provisions, which were of bad quality; hence they were in a state of great despondency. In many places they subsisted chiefly on the coarsest kind of bran, called Pollard, and upon weeds.

5. The prevalent disease was considered by all to be the common continued fever of the country; the disease became shorter and milder before it ceased to be epidemical; at last the five-day fever, with frequent relapses, was very common.

6. In these two counties the same means were adopted for the relief of the poor, as in other parts of the province; committees of the upper ranks met and obtained subscriptions for the purposes of separating the sick from the uninfected, of purifying their persons and houses, and supplying the convalescents with nourishment.

At Drogheda, the county infirmary was converted into a fever hospital while the epidemic lasted. At Dundalk, a board of health was established, consisting of the resident clergy, medical practitioners, and neighbouring gentry; a fever hospital was hired; and great promptitude, zeal and judgment were manifested by the inhabitants, in the measures which were adopted for the relief of the sick. It was the opinion of a respectable practitioner of medicine at Kells, where there are many resident gentry who are uniformly attentive to the interests of the poor, that the fever was less general than it would have been, and than it was elsewhere, owing to the abundant supplies of provisions afforded by the opulent inhabitants of that neighbourhood, to the labouring poor during the time of scarcity. And at Navan it was thought that the soup kitchens, which were established in anticipation of a famine, had been instrumental in keeping down the fever. The poor in these places submitted with admirable patience to all their hardships, which they considered as inevitable, receiving with gratitude the benefits which were conferred upon them by their superiors.

It is worthy of record, that in the county of Louth, the fever disappeared every where shortly after employment was restored to the poor. And the linen trade having acquired a vigour which it had not possessed for several years, the poor were generally employed, and potatoes were cheap and of good quality; and hence perhaps the excellent state of the public health at the time of my inspection of that county.

7. The disease frequently recurred in the same individual, and affected whole families more than once; but most persons believed that those who had had the fever were less liable to it than the unseasoned.

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The fever did not produce any permanently bad effect on the constitution.

8. The disease every where extended through the families of the poor; all who were employed in tending the sick in hospital, were affected with it. It was fatal to a
9. physician and two apothecaries at Dundalk, who attended the fever hospital of that
town. In Slane, fever first appeared in a house in which travellers of the poorest description lodge. There was not a case of fever in the town until two strangers from Ardee came to that lodging house, shortly after which fever appeared in the family; it was then ascertained that the strangers had just recovered from fever, which had raged at Ardee. The second family in which fever appeared, was one between which and that first infected, there was constant communication; the next individual affected was the physician to the dispensary, who had been visiting in both houses: then the disease became general.

Dublin.

County of
Dublin.

THE *recapitulation* of the general return* of fever patients admitted into the Dublin hospitals, during nineteen months, ending 31st March 1819, which is added to this report, will show the rise, progress, and present decline of the epidemic in the city
1. of Dublin. With some trifling exceptions, fever is on the decline in the county of
Dublin.

2. Fever has been general among the poor in all parts of Dublin, but especially in the more crowded and filthy streets, lanes, and courts of the city. The general state of health of the garrison of Dublin, as indeed of the troops all over the kingdom, has been excellent. In most of the large charitable institutions, where food of the usual quality and quantity has been served out, there has been no increase of fever.

3. The epidemic commenced in the city of Dublin, about the 1st of September 1817. It was first observed in Barrack-street, Church-street, and the adjoining lanes. These lanes are in the line of the northern and western roads; and it was ascertained that fever had been previously spreading in many of the villages, which communicate with Dublin by means of these roads. In some of these villages no increase of disease was observed, until the labourers from Conaught and from some parts of Ulster, came up in 1817, in quest of harvest work. In 1817 they came up in the beginning of July, or even earlier, driven from home by famine. Thus at Kilcock (in which there are sometimes 3,000 labourers at one time from Roscommon and Mayo) no increase of fever was observed among the inhabitants till the latter end of August; prior to which, however, many cases of fever were observed among the Conaught labourers, who lodged in the cabins around Kilcock. Many of the inhabitants of Dunbayne, Maynooth, and Swords, (all stations for labourers from Roscommon, Mayo, Leitrim, Sligo, Cavan, and Monaghan) who laboured under fever in the month of September, when they understood the nature of their illness, had themselves conveyed into Dublin, and took up their abode in Barrack-street, Church-street, &c. in hopes of getting into an hospital; and thus they introduced disease into these streets, which has maintained its ground in them ever since. Fever prevailed among the county of Dublin mountains, above Stepaside and about Kilgobbin and Kilternan, in the end of 1816, at which time hardly a cabin escaped.

4. The condition of that part of the community which suffered most in Dublin, will appear from a Report made to the governors of the House of Industry, by their inspectors, of the state of Barrack-street and Church-street; the streets which supplied the hospitals of the house of industry with the greatest number of fever patients, during the months of September, October, November, and December 1817.

"Barrack-street and Church-street are on the north side of the Liffey, and in the line of the northern and western roads. Barrack-street is nearly parallel with the Liffey, between which and its eastern extremity are yards for cattle and slaughter-houses: the river at high water is nearly on a level with the cellars. In Barrack-street there are 85 houses, the apartments of which are in general much crowded; thus 52 houses contain in 390 apartments, 1,318 persons; of which number 332 adults are unemployed: the greater number of whom are in a state of extreme indigence. There are several

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* The return was presented to Government by the Director-General of Military Hospitals.

IV. LEINSTER.

Bad state of Barrack-street and Church-street.

Soldiers and their followers.

Courts.

Cellars.

several public houses, which are much frequented, particularly in the evenings; and many of the cellars are used as public eating rooms. Soldiers and their followers have hitherto afforded means of subsistence to many room-keepers, who are now in great distress. During the last three months 111 persons have had fever, which appears in general to have arisen from contagion. Church-street consists of 181 houses, which, with those in the adjoining courts, are much more crowded than the houses of Barrack-street; thus, in 71 houses of this street and adjoining courts, consisting of 393 apartments, 1,997 persons dwell; of whom 628 are without employment. In Church-street, 123 persons have had fever within the last three months. Foul lanes, courts and yards are interposed, between this and the adjoining streets. A few respectable shopkeepers excepted, the entire street is inhabited by persons of the lowest order. There are many cellars which have no light but from the door, which in several is nearly closed by bundles of rags, vegetables, and other articles exposed to sale. In some of these cellars the inhabitants sleep on the floors, which are all earthen; but in general they have bedsteads. Most of the courts are crowded and filthy. Nicholson's court, which immediately joins the root market, contains 151 persons in 28 small apartments, of whom 89 are unemployed; their state is very miserable, there being only two bedsteads and two blankets in the whole court. Fever appeared in three apartments of this court; in one the whole family were sick, the individual first affected not having been removed; in the others only two persons were taken ill, owing to early removal and cleansing. The effect of early removal of the sick, and the cleansing and whitewashing of their apartments, was very remarkable in checking the progress of the disease in some families; while, from the neglect of these precautions, the number of the sick rapidly increased in others. Two neighbouring houses in Barrack-street, afforded an illustration of this remark, namely, Nos. 41 and 47. In the former the disease began in two different families, and its progress was immediately checked by early removal, cleansing, &c. In the latter, the individual first affected remained at home, and died of the fever, but not before he had communicated the disease to eighteen persons in a short time."

The epidemic was of later appearance in Dublin than in most parts of Ireland, which was probably attributable to provisions being of better quality and more abundant than elsewhere; perhaps something was also due to the exertions of the inhabitants who met at the mansion-house, and subscribed largely for the purpose of giving employment to the labouring poor.

5. The disease has been the same which is generally observed in Dublin; nor has any change in its character taken place, unless what may be accounted for by the change of seasons. Although the hospitals are now less crowded than they were, the cases are as severe as at any time since the epidemic commenced; and there were lately several cases of a malignant kind among the upper ranks.

6. Hospital accommodation at the expense of Government, has been afforded to all applicants, labouring under fever, in the city of Dublin; and of late, wholesome food has been supplied to convalescents for some time after their discharge from hospital. The several fever establishments having medical inspectors, whitewashers, &c. attached to them, have become each the centre of a district; the sick being for the most part accommodated in the hospital of the district in which they reside. Numerous scavengers paid by the governors of the house of industry, have been employed to remove filth from the areas, courts, and even houses of the poor, whereby all the poorer parts of the city are cleansed once a fortnight. Lastly, a committee of health, consisting of a governor and physician, deputed from each of the fever hospitals, has been appointed to promote concert in the operations of these establishments, and watch over the progress of epidemic disease.

Association of benevolent individuals in St. Peter's parish.

The important communications which have been made to his Excellency the Lord Lieutenant, by the governors and physicians of the different town hospitals, as well as by the central committee of health, render it unnecessary for me to dwell upon this part of the subject, which however I cannot dismiss without remarking, that an association, consisting of many benevolent individuals of St. Peter's parish, by instituting a system of minute inspection, followed by early removal of the sick to hospital, and careful purification of their houses, diminished for a time, the number of cases of fever in that parish. Their plan was rendered more efficient by the establishment of a disinfecting house, furnished with boilers and ovens for cleansing the clothes and bedding of the poor, by washing and stoving, as also by supporting those who had been in hospital, until they were fully restored to strength, whereby the danger of relapse was much diminished.

7. Relapses have been frequent, particularly in such patients as from having had short fevers were early discharged from hospital, or who insisted upon leaving hospital before they were fit for work. It is thought that relapses have been less frequent since nourishment began to be distributed to the convalescents, from the kitchens of the several hospitals.

8. The fever has been frequently followed by dysentery, dropsy, rheumatism, and, in the pre-disposed, by consumption; it has been much more injurious in its consequences in Dublin, than in the country.

9. I believe there is not a physician or medical inspector, belonging to the fever hospitals in Dublin, who entertains a doubt of the infectious nature of the disease. In the hospitals of the house of industry there were till lately 170 persons engaged in tending the fever patients; from which part of the establishment, within the last eighteen months, have been furnished 198 cases of fever. No clinical clerk, apothecary, or unseasoned nurse or servant, has escaped, and some have had the fever three or four times.* Similar observations have been made in the other hospitals; yet I have not heard of one instance of a second individual of a family, in the upper ranks in Dublin, being affected with the epidemic fever, such security do cleanliness and ventilation afford.

Summary of the Observations made during the foregoing Inspection of the Province of Leinster.

1. IT appears that continued fever has existed among the poor of the province of Leinster, for many years.

2. That in 1817, but more especially towards the close of that year, there was a great scarcity of wholesome food (in many parts amounting to a famine) and also of fuel; that the clothes of the poor were worn out; and that many of them were in a state of dejection of mind, from these hardships and from a general failure of employment.

3. That at this period the common continued fever of the country became epidemical among the poor; that at first it raged with severity, in some places carrying off considerable numbers; that it began to abate in severity about the middle of Summer 1818; since which time, that it has almost every where become less frequent also, so that in general it has ceased to be epidemical; that since it began to abate in severity, its course has been much shortened, but with a proportionate tendency to relapse.

4. That the disease has spread through families in which ventilation or cleanliness were neglected or unattainable; that it has been conveyed from one cabin to another by the friendly visitors of the sick; that it has been more widely disseminated by strolling beggars and labourers traversing the country in quest of employment; lastly, that the unseasoned servants of fever hospitals have, with scarce an exception, contracted the disease.

5. That in the upper ranks comparatively few have caught the fever, and of these a large proportion have been medical and clinical attendants upon the sick; that during the whole course of the epidemic, fever has been fatal in a proportion of one in four, or even one in three, among those affected with it in the upper or middling ranks, even while not one in thirty or forty died among the poor; that the disease has seldom if ever spread through families in which proper attention has been paid to ventilation and cleanliness.

6. Finally; that the disease has been most destructive in those parts of the country, where the poor have least intercourse with the rich.

Concluding

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* Dr. Macloghlin, a learned and scientific physician, died last night of fever, which there is every reason to think he caught in the exercise of his office of inspector.—April 8th, 1819.

IV.
LEINSTER.

Concluding Observations.

THUS I have endeavoured to ascertain, by inquiry made on the spot, the exact state of Fever throughout the province of Leinster. The Lord Lieutenant has been further pleased to command me to submit in detail, for his Excellency's consideration, such medical or preventive measures as may prove the means, not only of relieving the persons afflicted with contagious fever, but of checking its future progress in their dwellings: on these measures, however, I fear I have nothing new to offer; indeed I know little of this part of the subject but its difficulties.

Various plans have been formed by benevolent persons with whom I have conversed, for the complete extinction of fever in Ireland; most of which plans concur in two points: namely, in the general establishment of fever hospitals, and of boards of health.

The general establishment of fever hospitals is entitled to more consideration than has been bestowed upon it: the following are some of the objections to which it appears liable. The multiplication of hospitals in the country would afford the rich but too plausible an excuse for neglecting the indigent sick. By furnishing the poor with a ready asylum in their sickness, these institutions would have a tendency to make them even less provident than they are; while at the same time they would still farther weaken that spirit of independence which ought to be encouraged in the poor of this country. Lastly, to meet an occasional evil, a permanent expense would be entailed upon the districts in which such hospitals should be established. Fever hospitals in large towns, under the superintendence of active, intelligent, and zealous governors, are admirable institutions, adding much to the security and comfort of the opulent; and, in the present crowded state of the dwellings of the poor, materially checking the progress of disease. But in the country parts of Ireland, I should apprehend, in addition to the objections already stated, that permanent establishments of this kind, although at first they might be given to such medical practitioners as have distinguished themselves by their humane and disinterested attention to the poor, and although their discipline for a time might be exact, would eventually, when zeal became cold, be liable to the same abuses which have crept into similar institutions in many parts of Ireland. It seems better that these establishments in the country should be provisional. Temporary fever hospitals, to meet an exigency such as that which providentially is now nearly over, might be erected in a few days, at a trifling expense. I have an estimate in my possession for a fever hospital, which it was in contemplation to build at Ballytore, for the accommodation of 15 or 16 patients; which estimate amounts to £. 48. 6*s.*, whereas a permanent hospital for the same number of patients would probably have cost nearly a thousand pounds; and now that there is not a single case of fever in that town, it would have been empty and neglected, in which case it would soon have become ruinous. In Wexford I saw 20 patients in a shed, which answered all the purposes of a fever hospital, and which cost only £. 50. Perhaps some of the existing establishments, such as the county infirmaries, might, during the pressure of epidemic disease, be converted into fever hospitals; and the well-known fact, that, during the existence of an epidemic, all other diseases are comparatively rare, would sanction this occasional appropriation of these institutions to a purpose for which they were not originally intended.

Fever hospitals in large towns.

Had the epidemic been confined to one town, barony, or even county, it is probable that it might have been subdued; but I suspect that nothing short of the means employed for putting down the Plague, would have accomplished its subjugation. Ample hospital accommodation, a complete organization of medical police, with a cordon of armed constables or troops to cut off all communication between the district in question and the surrounding country, would have been necessary. Whether these means, involving great expense in an exhausted country, and probably rendering the supply of provisions still more difficult than it actually was, would have been advisable, it is for others to determine. But in the present instance disease was universal, and the wildest speculator could scarcely expect a simultaneous movement in every part of the kingdom, with a view of subduing it; nay, had the disease been a mortal plague instead of a mild fever, such a concurrent exertion could not have been obtained. For it is obvious, that the only sure foundation for such a movement, namely, an intelligent Board of Health, with all the apparatus of hospitals, convalescent and disinfecting houses, &c. however practicable at Wexford, Tullamore, Portarlington or Kells, or where there are many independent and benevolent persons, and however useful it might prove in these places, was inapplicable to those parts of the country in which the epidemic was most destructive, from there being no residents of authority, and sufficient information in these districts to carry it into effect. Fever obviously committed its greatest ravages where the poor were supine, from the absence of persons of superior rank to protect and encourage them during the season of their calamity; while, on the other hand, it did not ravage those districts where that duty was performed by residents of character and independence: the want of such persons, however, unfortunately was much felt during the late crisis, in many parts of the province of Leinster.

Ravages of fever where the poor were supine.

I believe that every attempt made to suppress disease, however incomplete, was of use; was useful, not merely by instructing the poor in the nature of the difficulty with which they had to struggle, and showing them how to contend against it; but moreover by making them feel that they were objects of sympathy, they were encouraged to resist an evil which always grows by neglect.

Indeed, were these associations for the relief of the poor when in sickness, permanently established in places which could not maintain a Board of Health, they would do more towards restraining the spread of disease, than any measure which has been suggested. The individuals composing them would become familiar with the miseries of the poor; and when any unusual sickness should again occur, then experience in the work of charity would enable them to apply the proper remedies with a prompt and skilful hand. For it is certain, that the poor in some places were left to struggle with their misfortunes, unaided by their superiors, not from an unwillingness on the part of the latter to assist them, for the spirit every where was excellent, but from ignorance of any effectual method of doing so.

Were such associations general, they would go far towards supplying one of the greatest *desiderata* in this country, namely, a more frequent intercourse between the upper ranks and the poor. The individuals composing these societies must, however, be connected by no tie but charity. Such societies having no subordinate officers, as clerks, inspectors, &c. but doing their work themselves. No measures would be more useful and certainly more popular in most parts of this country, than associations which have the sanction of law; and it is a strong recommendation of them, that they lately existed in many places and were productive of great advantages. All that is desired, is to convert a temporary and partial into a permanent and general benefit.

In order to give efficiency to these associations, it would be necessary to establish a Board of Health in Dublin, to which they might apply for advice and assistance, when difficulties should arise; which, unassisted, they might find themselves unable to overcome. By means of a Board of Health corresponding with those associations, with the clergy, magistrates and physicians, in different parts of Ireland, Government might obtain the earliest information relative to every occurrence tending to injure the health of the community, whereby preventive or remedial means would be provided without delay. The establishment of a Board of Health might also lay the foundation of a general system of medical police, which would probably lead to an increase of the comforts of the poor.

I would not presume to bring the foregoing proposal under the consideration of his Excellency the Lord Lieutenant, had it not been sanctioned by the approbation of some professional gentlemen, who have bestowed much attention on the health of the poor, and on whose judgment I place every reliance.

A record of the inspection of this kingdom, by which the rise, progress, and present state of disease has been ascertained, will form an official document of great value. It will illustrate the laws of epidemics, as well as the measures which may be employed for alleviating the miseries which they occasion. Epidemics of the same kind have, from time to time, occurred in Ireland from the same cause,* namely a failure of the usual supply of nourishment; which in many places were equally fatal with that under consideration, but these were not sufficiently attended to, and are now forgotten; so that when, on the present occasion, disease arose and became general, we were ignorant of the course which it was likely to pursue. The assistance humanely afforded to a suffering people, by his Excellency's commands, is also upon record; and should this country again fall under a similar visitation, in distributing the bounty of Government, the advantage of experience will be superadded to just principles.

J. Cheyne.

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* One within these twenty years.

IV.
LEINSTER.

APPENDIX.

DUBLIN.

Patients admitted into the Hardwicke Fever Hospital, House of Industry, and the Fever Hospital Cork-street; from the year 1804, when they were established, to September 1st, 1817.

		Hardwicke Hospital. N° Admitted.	Cork-street Hospital. N° Admitted.
In the year	1804	82	422
—	1805	709	1,028
—	1806	1,276	1,272
—	1807	1,289	1,092
—	1808	1,473	1,072
—	1809	1,176	1,076
—	1810	1,474	1,774
—	1811	1,316	1,478
—	1812	2,006	2,273
—	1813	1,870	2,620
—	1814	2,026	2,398
—	1815	2,451	3,787
—	1816	1,669	2,785
to September 1,	1817	923	1,865

General Recapitulation of Fever Patients admitted into the Dublin Hospitals, during 18 Months, commencing 1st September 1817, and ending 28th of February 1819; divided into Periods of Three Months.

First Period:
Total of Admissions during three months, ending 30th November 1817 - 2,752
Total number of Deaths in ditto - - - - - - - - 168
Mortality somewhat below one in 16;
Average daily Admissions somewhat more than 30.

Second Period:
Total of Admissions during three months, ending 28th February 1818 - 4,344
Total number of Deaths in ditto - - - - - - - - 288
Mortality somewhat below one in 15;
Average daily Admissions somewhat more than 48.

Third Period:
Total of Admissions during three months, ending 31st May 1818 - - 5,297
Total number of Deaths in ditto - - - - - - - - 221
Mortality somewhat above one in 24;
Average daily Admissions nearly 58.

Fourth Period:
Total of Admissions during three months, ending 31st August 1818 - - 7,377
Total number of Deaths in ditto - - - - - - - - 226
Mortality somewhat below one in 32;
Average daily Admissions somewhat more than 80.

Fifth Period:
Total of Admissions during three months, ending 30th November 1818 - 8,611
Total number of Deaths in ditto - - - - - . - - - 350
Mortality one in 22 nearly;
Average daily Admissions upwards of 94½.

Sixth Period:
Total of Admissions during three months, ending 28th February 1819 - 6,870
Total number of Deaths in ditto - - - - - - - - 365
Mortality aboot one in 19;
Average daily Admissions somewhat more than 76.

IV.
LEINSTER.

Return of Fever Patients admitted into the Dublin Fever Hospitals; for one Month, commencing the 1st, and ending the 31st of March 1819, both days inclusive.

House of Industry:

Patients in hospital, 28th February 1819		501
Admitted from 1st to 31st March 1819 — City	643	755
Country	112	
		1256
Discharged cured	756	1,256
Died	53	
In hospitals, 31st March 1819	447	

Mortality, one in 14.

House of Recovery, Cork Street:

Patients in hospital, 28th February 1819		203
Admissions from 1st to 31st March		496
		699
Discharged cured	464	699
Died	25	
In hospital, 31st March 1819	210	

Mortality, one in 20.

STEEVENS's Hospital:

Patients in hospital, 28th February 1819		76
Admissions from 1st to 31st March		223
		299
Discharged cured	219	299
Died	4	
In hospital, 31st March 1819	76	

Mortality, one in 56.

Sir P. DUNN's Hospital.

Patients in hospital, 28th February 1819		88
Admissions from 1st to 31st March 1819		200
		288
Discharged cured	175	288
Died	13	
In hospital, 31st March 1819	100	

Mortality, one in 15.

WHITWORTH Hospital:

Patients in hospital, 28th February 1819		30
Admissions from 1st to 31st March 1819		28
		58
Discharged cured	32	58
Died	3	
In hospital, 31st March 1819	23	

Mortality, one in 9.

Recapitulation.

Total of admissions during the months ending 31st March 1819	1,702
Total number of deaths in ditto	98

Mortality, one in 17 ⅓.—Average daily admissions, 58.

Note.—In order to institute an accurate comparison of the admissions of fever patients into the Dublin hospitals, for the months of February and March 1819, we must add three days to the former month, to make the total number of days alike; namely, 31. Taking, therefore, the daily admissions at 58, we add three times that number, namely, 174, to 1,684, the total of admissions during February 1819, which forms a total, 1,858, or 156 more than the admissions during March 1819.

Return

IV. LEINSTER.

Return of Fever Patients admitted into the Dublin Hospitals; for one Month, commencing the 1st, and ending the 30th of April 1819, both days inclusive.

House of Industry:

Patients in hospital, 31st March		447	
Admissions from 1st to 30th April	City 372 County 87	459	906
Discharged cured	621		
Died	37	906	
In hospital, 30th April	248		

Mortality, about one in 12¼.

House of Recovery, Cork Street:

Patients in hospital, 31st March		210	
Admissions from 1st to 30th April		404	614
Discharged cured	406		
Died	23	614	
In hospital, 30th April	185		

Mortality, about one in 18.

Steevens's Hospital:

Patients in hospital, 31st March		76	
Admissions from 1st to 30th April		212	288
Discharged cured	198		
Died	11	288	
In hospital, 30th April	79		

Mortality, one in 19.

Sir Patrick Dunn's Hospital:

Patients in hospital, 31st March		100	
Admissions from 1st to 30th April		207	307
Discharged cured	193		
Died	11	307	
In hospital, 30th April	103		

Mortality, about one in 19.

Whitworth Hospital, Drumcondra:

Patients in hospital, 31st March		23	
Admissions from 1st to 30th April		29	52
Discharged cured	35		
Died	2	52	
In hospital, 30th April	15		

Mortality, about one in 15.

Recapitulation:

Total of admissions during the month ended 30th April 1819	1,311
Total number of deaths in ditto	84

Mortality, about one in 16.—Average daily admissions, about 44.

Note.—In order to institute an accurate comparison of the admissions of fever patients into the Dublin hospitals, for the months of March and April 1819, we must add one day to the latter month to make the total number of days alike; namely, 31. Taking, therefore, the daily admissions at 44, we add that number to 1,311, the total of admissions during April 1819, forms a total of 1,355, or 347 less than the admissions during March 1819.

G. Renny, M.D.

Right Hon. Charles Grant.
&c. &c. &c.

Medical Report of the Fever Hospitals of STRATFORD-on-SLANEY and BALTINGLASS, from their commencement to the 27th of February 1819; County Wicklow.

DATE.	Admissions.	Discharges.	Deaths.	DATE.	Admissions.	Discharges.	Deaths.
1817. May - -	2	2	—	1818. April - -	26	24	—
„ June - -	7	5	—	„ May - -	33	32	—
„ July - -	8	8	—	„ June - -	28	34	—
„ August -	13	12	—	„ July - -	26	25	—
„ September	10	10	—	„ * August -	57	57	—
„ October -	16	12	1	„ September	18	19	—
„ November	12	14	1	„ October -	37	25	—
„ December -	14	12	—	„ November	68	65	3
1818. January -	49	39	1	„ December -	54	37	2
„ February -	33	31	1	1819. January -	79	56	2
„ March - -	31	32	1	„ February -	39	42	5
50 patients in hospital 26 February 1819.				TOTAL -	660	593	17

* Stratford hospital being so crowded at this period, it was determined to get another hospital, which was accordingly established in Baltinglass.

During this present month (February 1819) the cases of fever that have occurred are generally of a more malignant sort than usual, as may be inferred by the number of deaths.

Fever Hospital, at NEWTOWN MOUNT KENEDY, County Wicklow.

Patients received into hospital, from July 1817 to 28th February 1818, from the parishes of Delgany and Newtown Mount Kenedy - -	204
Deaths - - - - - - - - - - - -	6
From 1st of March 1818, to 15th February 1819 - - - -	153
Deaths - - - - - - - - - - - -	10
In hospital 16th February 1819 - - - - - - - -	11

Fever Hospital, Wicklow.

Patients received into hospital from 6th September 1818, to 1st February 1819 - - - - - -	203
Deaths - - - - - - - - - -	5

Hospital discontinued for want of funds.

Fever Hospital, RATHDRUM, County Wicklow.

Admitted from August 12th, 1818, to February 16th, 1819 - -	350
Died - - - - - - - - - - - -	4
In hospital - - - - - - - - - - -	* 18

* These were all convalescent.

A Return of the Fever Hospital, at BRAY, County Wicklow; from it first establishment on the 18th of September 1818, to the 8th April 1819.

	1818:				1819:				Total.
—	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	
Admitted - - -	10	22	8	12	16	13	9	1	91
Discharged - -	3	15	19	7	16	12	12	- -	84
Died - - - -	- -	- -	2	- -	- -	1	- -	- -	3
Now under treatment	- -	- -	- -	- -	- -	- -	- -	- -	4

Fever Hospital, Arklow, County Wicklow.

Admitted in	Patients.	Admitted in	Patients.	Admitted in	Patients.
818, January -	7	1818, July - -	12	1819. January -	19
,, February	5	,, August -	13	,, February	21
,, March -	4	,, September	18	,, March -	16
,, April -	5	,, October -	25	to 8th April - -	4
,, May - -	12	,, November	23		
,, June - -	9	,, December	26	Total - -	219

Discharged cured, 212. Died 1. In hospital 8 April, 6.

Dispensary, Newtown Barry, County Wexford:

From February 1818 to February 28, 1819 - - - - 91 Patients.
Died - - - - - - - - 1 —

Dispensary Enniscorthy, County Wexford:

From February 1818 to February 17th, 1819, - -	434	Patients.
Recovered - - - - - -	431	—
Died - - - - - - -	3	—
Under cure - - - - - -	36	—

Fever Hospital, Gorey, County Wexford:

Date.	Admitted.	Died.	Date.	Admitted.	Died.	Date.	Admitted.	Died.
1817. November	4	—	1818, April - -	6	1	1818, September	17	—
December	16	—	May - -	31	1	October -	16	—
1818. January -	17	—	June - -	23	—	November	16	—
February	14	—	July - -	16	1	December	14	1
March -	6	—	August -	16	—	1819, January -	25	—

237 Admitted. 4 Died. 214 Discharged. 18 In hospital.

Fever Hospital, Wexford:	Admitted.	Discharged.	Died.
1815. December - - - - - - -	8	8	—
1816. From January to March - - - -	28	19	2
- - - April to June 30th - - - -	17	18	1
- - - July to September 30th - - -	9	13	—
- - - October to December 31st - -	11	10	1
1817 - - January to March 31st - - -	16	16	1
- - - April to June 30th - - - -	27	19	—
- - - July to September 30th - - -	22	28	—
- - - October to December 31st - -	25	24	—
1818 - - January to March 31st - - -	36	27	2
- - - April to June 30th - - - -	35	35	1
- - July to September 30th - - -	97	75	1
- - - October to December 31st - -	90	78	4
1819 - - January to February 28th - -	76	79	3
Total - - - -	497	449	16

Fever Hospital, New Ross.

	Admitted.	Discharged.	Died.
From July 1st 1809 to July 1810 - - - -	28	24	2
- - - - - 1810 - - 1811 - - - -	81	75	5
- - - - - 1811 - - 1812 - - - -	39	40	1
- - - - - 1812 - - 1813 - - - -	39	36	3
- - - - - 1813 - - 1814 - - - -	44	40	3
- - - - - 1814 - - 1815 - - - -	107	97	3
- - - - - 1815 - - 1816 - - - -	76	80	3
- - - - - 1816 - - 1817 - - - -	174	161	—
- - - - - 1817 - - 1818 - - - -	317	270	6
Total - - -	905	823	26

Fever Hospital, New Ross—*continued.*

Remaining under Cure:	Patients.	Admitted during Month.	Discharged cured.	Died.
July 1st - 1818 - - - - -	51	95	73	1
August - ,, - - - - -	72	87	91	1
September ,, - - - - -	67	82	79	—
October - ,, - - - - -	70	86	91	—
November - ,, - - - - -	65	65	68	1
December - ,, - - - - -	61	46	62	1
January - 1819 - - - - -	44	44	56	—
February - ,, - - - - -	32	47	42	1
March - ,, - - - - -	36	—	—	—
TOTAL - -	498	552	562	5

Tabular View of the Admissions and Deaths of the Fever Hospital, KILKENNY; commencing the 1st of March 1803, and ending the 1st of March 1816.

For One Year, from the 1st of March	ADMISSIONS:			DEATHS:		
	Males.	Females.	TOTAL.	Males.	Females.	TOTAL.
1803 - to 1st March - 1804	39	34	73	2	2	4
1804 - ,, - 1805	43	37	80	6	4	10
1805 - ,, - 1806	35	34	69	3	2	5
1806 - ,, - 1807	23	33	56	1	1	2
1807 - ,, - 1808	40	41	81	2	3	5
1808 - ,, - 1809	39	57	96	2	3	5
1809 - ,, - 1810	54	62	116	4	3	7
1810 - ,, - 1811	64	71	135	5	6	11
1811 - ,, - 1812	66	87	153	1	5	6
1812 - ,, - 1813	78	78	156	2	3	5
1813 - ,, - 1814	79	104	183	2	2	4
1814 - ,, - 1815	112	124	236	8	5	13
1815 - ,, - 1816	119	130	249	5	7	12
1816 - ,, - 1817	85	77	162	11	6	17
TOTAL - -	876	969	1,845	54	52	106

IV. LEINSTER.

Quarterly Return of the Fever Hospital, KILKENNY; from the 1st March 1817, to 1st March 1819.

For three Months from	ADMISSIONS: Males.	Females.	TOTAL.	DEATHS: Males.	Females.	TOTAL.
1st March to 1st June - 1817	46	50	96	1	3	4
„ June „ September „	78	75	153	9	6	15
„ Sept. „ December „	180	199	379	13	7	20
„ Dec. „ March - 1818	210	262	472	11	6	17
„ March „ June - „	233	297	530	19	14	33
„ June „ September „	294	303	597	16	14	30
„ Sept. „ December „	258	207	465	21	21	42
„ Dec. „ March - 1819	171	161	332	20	13	33
TOTAL - -	1,470	1,554	3,024	110	84	194

RECAPITULATION:	Males.	Females.
Total number of Patients admitted, from 1st March 1803 to 1st March 1817 - - - - - - - - -	876	969
Total number of Patients admitted, from 1st of March 1817 to 1st March 1819 - - - - - - -	1,470	1,554
Grand Total - -	2,346	2,523

Total Males and Females - - 4,869.

	Males.	Females.
Total number of Deaths, from the 1st March 1803 to 1st March 1817 - - - - - - - - -	54	52
Total number of Deaths, from the 1st March 1817 to 1st March 1819 - - - - - - - -	110	84
Grand Total - -	164	136

Total Males and Females - - 300.

Average mortality of Males, one in $14\frac{1}{3}$ nearly,
Average mortality of Females, one in 18 nearly. } General Average as 1 to $16\frac{1}{5}$.

Report of the Fever Hospital in the Barony of PORTNEHINCH, in the Queen's County; from 25th July 1818, to 28th February 1819.

MONTH.	Admitted.	Discharged.	Died.	MONTH.	Admitted.	Discharged.	Died.
1818. July 25 - -	20	—	—	1818. December -	76	79	3
August 31 -	27	19	1	1819. January 31	56	63	1
Sept. 30 -	86	70	1	February 28	40	.35	3
October 31	102	82	5				
Nov. 30 -	108	122	2				
Remaining under Treatment - 29				TOTAL - - -	515.	470	16

KILCULLEN Fever Hospital, County of Kildare:

Patients admitted from 1st March to 1st June 1818 - - 74; Died - - —
Patients admitted from 1st June to 1st September 1818 - 131; Died - - 3
Patients admitted from 1st Septemʳ to 1st Decemʳ 1818 - 122; Died - - 1
Patients admitted from 1st Dec. 1818 to 1st March 1819 - 93; Died - - 1
Total admitted, 420. Died, 5. Remaining in hospital, 26.

Report of the NAAS Fever Hospital, County of Kildare:

Admitted from 10th March 1818 to 10th March 1819 - - 427
Discharged cured 400; Died 13; In Hospital 14; - - TOTAL 427

Of the deaths five were Conaught men, who had been lying in the fields under the ditches for many days previous to admission, at which time they were in a dying state.

IV.
LEINSTER.

Return of the Fever Hospital, TULLAMORE, King's County:

Admitted from 13th July 1817 to 31st July 1818	237
Died	12
Admitted from 31st July 1818 to 5th March 1819	140
Died	4

Remaining in hospital, of whom 9 are convalescent.

Return of PARSONS-TOWN Fever Hospital, King's County; from 21st August 1817, to 28th February 1819.

			Admitted.	Discharged.	Died.
From 21st August	to 1st October	1817	32	16	—
1st October	November	—	26	23	1
November	December	—	30	17	1
December	January	1818	25	18	2
January	February	—	24	27	1
February	March	—	24	29	2
March	April	—	19	17	2
April	May	—	20	21	5
May	June	—	27	21	2
June	July	—	27	16	—
July	August	—	42	36	—
August	September	—	20	21	—
September	October	—	27	35	—
October	November	—	28	24	—
November	December	—	22	24	—
December	January	1819	11	17	1
January	February	—	15	12	—
February	March	—	6	18	1
		TOTAL	425	392	18

KING'S COUNTY.

Return of Extern Patients, under Medical Treatment; from 21st August 1817, to 28th February 1818; Parsons-town.

—			Under Treatment.	Cured.	Died.
From 21st August	to 1st October	1817	24	18	—
1st October	to 1st November	—	22	14	1
November	December	—	36	14	—
December	January	1818	24	23	2
January	February	—	17	22	—
February	March	—	22	23	—
March	April	—	26	19	—
April	May	—	28	29	—
May	June	—	18	26	—
June	July	—	19	24	—
July	August	—	30	28	—
August	September	—	15	19	—
September	October	—	12	16	—
October	November	—	12	7	—
November	December	—	7	15	—
December	January	1819	4	12	—
January	February	—	7	11	—
February	March	—	1	1	—
		TOTAL	324	321	3

Dispensary, Killucan, County Westmeath.

Month.	Admitted.	Died.	Month.	Admitted.	Died.	Month.	Admitted.	Died.
1817. August 27	10	—	April - 1818	61	1	October 1818	10	—
September	21	—	May - —	33	—	November —	26	—
October -	40	—	June - —	45	1	December —	15	1
November	28	1	July - —	34	—	January 1819	6	—
1818. January -	30	—	August - —	18	—	February —	—	—
February	35	1	September —	5	—	March - —	10	—
						Total - -	427	5

Report of the Fever Hospital, Kells, County Meath; from 19th September 1817, to 30th March 1819.

DATE.	Admission.	Discharge.	Deaths.
1817. From 19th September to 18th October - -	50	29	1
— — 19th October to 18th November -	31	36	—
— — 19th November - - December - -	29	24	—
1818 — December - - January - -	20	17	1
— — January - - February - -	14	20	—
— — February - - March - - -	13	5	—
— — March - - - April - - -	10	14	—
— — April - - - May - - -	19	20	—
— May - - - June - - -	27	27	1
— — June - - - July - - -	26	22	—
— — July - - - - August - -	28	27	—
— — August - - - September -	30	30	3
— — September - - October - -	25	25	1
— — October - - - November -	20	20	3
— — November - - December - -	14	17	—
1819 — December - - January - -	17	10	1
— — January - - February - -	6	16	2
— — February - - March - - -	7	4	—
— March - to 30th March - - -	3	3	—
Total - - -	389	366	13

IV. LEINSTER.

A Monthly Report of the DUNDALK Fever Hospital; commencing 22d August 1817, the day on which the Hospital was established.

			Admitted.	Discharged.	Died.
1817.	September	22d	102	48	4
	October	—	156	122	8
	November	—	101	94	7
	December	—	79	92	2
1818.	January	Returns deficient.	—	—	—
	February				
	March				
	April				
	May				
	June				
	July	22d	52	47	1
	August	—	64	64	—
	September	—	44	57	1
	October	—	43	36	1
	November	—	34	33	—
	December	—	40	39	2

Receipts:

	£.	s.	d.
Received from Government on 18th October 1817	75	—	—
" " 11th December "	50	—	—
Private subscription to 22d February 1819	577	6	10
County presentment	70	—	—
Received from Government 8th June 1818	75	—	—
	£. 847	6	10

In hospital 1st January 1819	20	55
Admitted to 19 February	35	
Discharged	40	55
Died	—	
In hospital 19 February	15	

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(Ireland.)

SECOND

REPORT

FROM THE

SELECT COMMITTEE

On the State of Disease, and Condition of the Labouring Poor, in Ireland.

Ordered, by The House of Commons, *to be Printed,*
7 *June* 1819.

THE REPORT - - - - - - - - - - - - p. 95

MINUTES OF EVIDENCE - - - - - - - - - 101

APPENDIX;—Viz. The Four Reports from the Commissioners on the nature and extent of the Bogs in Ireland, (1810, 1811, & 1814;) with Extracts from the several Appendixes - - - - - - 121

SECOND REPORT.

THE SELECT COMMITTEE appointed to inquire into the State of *Ireland*, as to Disease, and how far the Measures, remedial and preventive, adopted by the Legislature or otherwise during the last year, have been effective for its removal or mitigation; and also into the Condition of the Labouring Poor of that part of the United Kingdom, with a view to facilitate the application of the Funds of private Individuals and Associations, for their Employment in useful and productive Labour; and to report their Observations; together with their Opinion on these Subjects, from time to time to The House;—HAVE, pursuant to the Order of The House, further inquired into the matters to them referred, and have agreed to the following REPORT:—

YOUR Committee having reported on the subject of Contagious Fever, that most calamitous indication of general distress in *Ireland*, have directed their attention to the other great branch of the duty devolved on them, viz. The Employment of the Poor.

In considering that most important topic, Your Committee find themselves in a great measure controlled by the unquestionable principle, that legislative interference, in the operations of human industry, is as much as possible to be avoided. There are, nevertheless, considerable exceptions to such a rule, either when injurious artificial impediments are to be removed, or where any branch of national industry, which cannot in its commencement be without great difficulty carried on by individual exertion, and solely by private funds, may be encouraged and facilitated by Parliamentary Regulation. With such qualifications, Your Committee have directed their attention to the deficiency of Employment amongst the People, and the Remedies which suggest themselves.

The general Distress and deficiency of Employment are so notorious, as to render it unnecessary for Your Committee to encumber their Appendix with particular Evidence to establish the extent and variety of the evil.

With especial regard to the limits of the specified exceptions from the general rule, Your Committee have directed their Inquiries particularly to two most important departments of labour in *Ireland*, that employed in agriculture, and that of the fisheries; they are likewise those to which the greatest extension may be given without hazarding reaction.

Upon the extent to which internal improvement and agricultural speculation may be pursued, with a confident expectation of adequate and permanent benefit in *Ireland*, Your Committee refer with satisfaction to the able scientific Evidence contained in the Reports of the Commissioners of Bogs, &c. presented to the House; they prove the immense amount of land in *Ireland*, easily reclaimable and convertible to the production of grain almost without limit for exportation. The Appendixes to those Reports considerably abridge the course which their duty would have pointed out to Your Committee. They suggest the subjects for agricultural exertions, and the mode of execution; and the small extent to which their recommendations have been acted upon, demonstrates lamentably that want of capital which in *Ireland* unnerves all effort for improvement.

Your Committee have examined one of the most eminent of the Engineers employed under that Commission, and refer to the important Evidence of that gentleman (Mr. Nimmo), and his valuable Observations on the drainages of Holland, Hanover, and England.

It is obvious, that in any general plan of improvement, not only much of the efficacy but of the economy of execution must depend on the degree of skill and science with which it is planned. In order to bring the subject more conveniently within the knowledge of the House, Your Committee have annexed in their Appendix, a selection from the Reports of the Commissioners of Bogs, of such parts as have a general application, disencumbered of all matter merely of local importance.

Under the head of Drainage, two different objects are pointed out in those Reports; first, clearing, lowering and embanking the different streams which have flooded so much low ground in all parts of that country, and which, in the opinion of eminent physicians, forms a fruitful source of Contagious Fever. Such works cannot there be executed under separate Acts of Parliament, to the expense of which those concerned are not equal.

The General Act for Sewers, 23 Hen. 8, c. 5, was framed upon
6 Hen. 6, c. 5.
8 Hen. 6, c. 3.
4 Hen. 7, c. 1.
6 Hen. 8, c. 10.
Extended to 5 years by
3 Edw. 6, c. 8.
To blowing Lands by
1 Mary c. 11.
To 10 years, &c.
13 Eliz. c. 9.
To all Waters within 2 miles of London, by
3 Jac. 1, c. 14.
To making Sales of Copyhold, by 7 Anne, c. 10.
22 Car. 2, the Commissioners of Sewers for London appointed by Mayor and Commons.
By 13 Eliz. the Ordinance made by any Commission, stand until repealed by a new Commission.

The ancient practice of England by Commissioners of Sewers, under the 23d of Henry the 8th, cap. 5, seems applicable to the case, and which has never yet been introduced into the Statute Law of Ireland, or consequently acted on there; with such view either the Grand Juries may be made Commissioners, or separate jurisdictions may be established for the purpose; and if effected by assessment, the success which has attended the road system would promise a competition for improvement.

Secondly, draining and reclaiming the great Bogs and Marshes. Those objects may properly be left to individuals or associations, as a profitable adventure, and legal provisions should be made for their repayment, by a portion of the ground, either in fee or lease. It was by such means that the great drainages of England were effected, in the last and preceding centuries. The Acts already existing for that purpose* should be amended, for the cases of individual proprietors, and a general Act passed, to facilitate and encourage private Acts, where there are a variety of interests.

A third and most important object recommended by the Commissioners, and to which Your Committee will advert, in connection with the

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* Vide 43 Eliz. c. 11 and many subsequent Acts.
12 G. 1. c. 12, for Bishops only.
5 Geo. 2, c. 9, for boundary Drains.
11 & 12 Geo. 3, c. 21, restricted to lots of 50 acres to Papists.

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the Fishery, in a subsequent part of this Report, is the formation of Roads in the mountain parts of *Ireland*: those districts, whilst they are subject to their proportion of the expense of county works, have not had their due share of the benefit of the Grand Jury system. In such districts it is peculiarly necessary, that Lines of Road and other works should be planned and superintended by skilful persons, the importance of which has been exemplified in the execution of the Highland Roads, and the present North Wales Road, compared to the former imperfect and expensive method.

Amongst the positive evils resulting from the want of employment and the impassable state of the Mountain Districts, is the facility, under the present circumstances of the country, of illicit distillation, with its consequent depravation of morals and loss to the revenue.

The want of capital in *Ireland* is attributable to various causes. Capital can accumulate only out of the savings of individuals. In *Ireland* there are few persons who, either in manufactures or agriculture, conduct their operations on such a scale as to admit of much surplus for accumulation. The manufacture which flourishes, the Linen, is spread abroad amongst a population which at the same time cultivates the soil for their sustenance; and though such a manufacture may be more conducive to health and morals in the manufacturer, it is more incompatible with large savings.

In like manner in agriculture, the tendency, from various causes, to subdivision of farms, and the general practice of throwing the expense of buildings and repairs on the tenant, countervail the accumulation of profit in the hands of the farmer, and the application thereof to beneficial enterprize in agriculture.

It is almost impossible in theory to estimate the mischiefs attendant on a redundant, a growing and unemployed population, converting that which ought to be the strength into the peril of a state. It is obvious, that the tendency of such a population to general misery, must be rapid, in proportion to the facility of procuring human sustenance, leading to the boundless multiplication of human beings satisfied with the lowest condition of existence.

That such a population, excessive in proportion to the market for labour, exists and is growing in Ireland, is a fact that demands the most serious attention of the Legislature; and makes it not merely a matter of humanity but of state policy, to give every reasonable encouragement to industry in that quarter of the empire.

In considering the causes which discourage industry in *Ireland*, it is impossible to overlook the lamentable circumstance, almost peculiar to that country, of the non-residence of a great proportion of the Proprietors; and especially of that portion which could most contribute, by their rank, their wealth and their moral influence, to operate beneficially on the habits and comforts of the lower classes. The expenditure of income in England, resulting therefrom, enhances the claim of *Ireland* on the generous consideration of Parliament.

On the subject of agricultural improvement, Your Committee, (controlled by the permanent principle of avoiding unnecessarily to tamper with so important a branch of industry, and leaving it to its best encouragement, the operation of a free market,) nevertheless think it necessary to point out the extent to which *Ireland* may be improved, and its power of production of human food vastly extended.

It appears in evidence, that there are of reclaimable Bog in *Ireland* two millions of Irish acres, of a soil suited to the production of grain; that the measures suggested by the scientific persons employed under the Bog Commissioners, much facilitate the application of private speculation to such improvements; and that in order to give efficacy to those suggestions, a General Inclosure and Drainage Act, on the principle of that for England, would be highly important; beyond that, as the basis for particular local Acts, Your Committee do not venture to go, save in recommending, that the powers given under the Act of last Session be extended to exempting from interest such advances as may be made for "Public Works," on due security for repayment of the principal within a limited number of years. A reference to the Reports alluded to will evince the great source of employment which the improvement of the Bogs of *Ireland* would offer to the population; and the facility of transport by canals through such level lines, would insure to England supplies of grain at moderate prices, which might render it wholly independent of foreign countries for the food of its manufacturing population.

The Mountain Districts of *Ireland*, at present comparatively unproductive, are capable of high improvement; they consist of about one and a half millions of Irish acres, of which it appears that about one half is suitable for agriculture, the remainder for much improved pasturage, for rearing or dairy purposes; and the entire eminently suitable for planting, much of the worst of it having been old forest land.

The nature of the evidence relative to those Mountain Districts has led Your Committee to consider of their improvement, in connection with that of the Fisheries, of which the principal lie along the coasts of those districts.

In whatever view it can be considered, whether as a source of national wealth, as a means of employing an overflowing population, or as a nursery of the best seamen, Your Committee cannot too strongly impress on the House the importance of the Irish Fishery. In addition to the evidence on that subject, stated in the Appendix, Your Committee have referred to several Reports of the Irish House of Commons, from the year 1733 to 1799, all demonstrating the highly advantageous situation of *Ireland*, as a seat of the fisheries, which could alone have been rendered unprofitable by a most perverse and injudicious system of laws.

The revision and simplification of those laws, and the direct application of encouragement under them to the resident fishermen of the coast, Your Committee consider essential to any successful fishery in *Ireland*.

The failure of the existing system may be proved by the fact established in the public Accounts, that while in the last year herrings were imported to the value of £. 58,197, the export trade, within the last three years, has fallen to a twentieth part of its former amount.

The actual condition of the Fishermen on the coast appears to be miserable; and yet their general habits, character and qualifications, are highly deserving of liberal encouragement.

It appears from the whole current of evidence, not only that the western, northern and southern coasts of *Ireland*, afford every advantage for a Bay or Coast Fishery, but that they are eminently suited for a deep sea Cod Fishery of great importance, calculated to afford permanent employment, independent of that for the production of oil from the whale and basking-shark, which abound in the contiguous seas. Without enlarging on the importance of this subject, Your Committee refer to the evidence in their Appendix, as well as the voluminous testimony contained in the Irish Journals before referred to, and they particularly call the attention of the House to that of Mr. Telford, which has enabled them to take the benefit of experience from an improved system of Fishery Laws, and of parliamentary encouragement, wisely applied and eminently successful in the case of Scotland. The inestimable benefits of the measure, which has opened through the Highlands of Scotland suitable lines of road into the seats of the Fisheries from the more improved districts, form a strong contrast to the numerous instances in which public money has been injudiciously applied to local objects. The establishment of successful Fisheries in consequence has materially augmented the national wealth, and opened sources of the most valuable industry; and it appears to Your Committee, that so extensive a national benefit was never attained for so moderate an expenditure.

In the case of Scotland, in 1802-3, the Treasury adopted the principle of applying the public money for the great ultimate public object of encouraging the Fisheries; and with that view, they ordered surveys to be made by skilful engineers, and approved a scheme for opening the Highlands on a prospective estimate of £. 150,000, to be met by an equal levy on the districts to be thereby improved; of the signal success of that scheme your Committee have the most satisfactory evidence.

On every ground of policy as well as justice, Your Committee earnestly recommend the application of the precedent of Scotland to the Highland Districts of *Ireland*. It appears in evidence, that the circumstances of the countries in question are remarkably similar; they are both mountainous and uncultivated, and abound with an unemployed population. The Irish soil is stated to be capable of higher cultivation, as better in itself, and equally abounding with manures, which at present cannot be transferred for its improvement beyond the mere precincts of the sea. It abounds with the best natural harbours for safe anchorage and shelter, but is deprived of the benefit of these from the want of piers or landing places, which it appears could be constructed at a moderate expense. These favourable fishing stations are also, for want of roads and bridges, cut off from intercourse with the interior, from which capital may be expected, and a market found for the coast fishery.

To all these natural claims to similar encouragement, those districts of *Ireland* add the very serious one, that from the non-residence of a majority of the proprietors, they do not possess within themselves the means of effecting those objects by private exertion. It appears moreover, that in the case of Scotland, no combination of private individuals, with equal funds, could have effected the same amount of good which has been wrought under the Parliamentary Commission for Scotland. And in any measures which the wisdom of Parliament may adopt, the power through which it is to be exercised should be removed from the influence of local interests and partiality in its application. It is no small recommendation of a similar experiment in *Ireland*, that the amount of money requisite for its completion is so small as not to present any obstacle, even in the present difficult situation of the finances of the State; and that its application would moreover be justified and facilitated, by the power possessed under the Grand Jury system of *Ireland*, of taxing the land to be improved in an amount equal to any public grant, by which much of the difficulties encountered in the Scots system would be avoided.

7 *June* 1819.

MINUTES OF EVIDENCE.

WITNESSES.

Mr. Alexander Nimmo;—Mr. Robert Fraser;—Thomas Telford, Esq.

Sabbati, 8° *die Maij,* 1819.

The Right Honourable Sir JOHN NEWPORT, Baronet,
In the Chair.

Mr. *Alexander Nimmo,* called in; and Examined.

Mr. Alexander Nimmo. (8 May.)

YOU have been lately in the county of Kerry; were there many poor willing to work, who could not get employment?—There were; the number of poor in the northern part of the county is so great, and such is the distress for want of employment, that several hundreds at a fair, lately, in the neighbouring county of Limerick, willingly hired themselves as labourers at four-pence a day.

Did they get their diet also?—Certainly not; the poor inhabitants of the village of Hospital were so exasperated at their tendering themselves as labourers at this rate, that they fell upon them, and nearly killed several of them, and some afterwards died.

What is the common rate of labour there?—Eight-pence a day; I had occasion to check the accounts of a public work in the neighbourhood, and that was the rate of labour.

Do you know of any work now undertaken, or likely to be undertaken, that can supply employment?—The Tralee mail-coach road, on which £. 14,000 is to be expended, is about to commence, and will furnish employment for two years; but that will only employ the people of that district; it is hoped, before the expiration of the time that the drainage of the bogs in the neighbourhood will commence, if not obstructed by legal and other difficulties. A very considerable body of proprietors have petitioned for leave to bring in a bill for that purpose; this, however, only applies to one part of the county of Kerry; the difficulties I alluded to are, the want of funds to make the primary advances. The extent of the bogs to be drained are 30,000 statute acres.

What do you consider as the legal difficulties to the effecting of the drainage of this and other bogs and waste grounds?—I will furnish the Committee with a statement of them at a subsequent opportunity.

Have you been employed under the commissioners of bogs in Ireland as an engineer, and had any opportunity of seeing improvements of that nature elsewhere?—I have, in the county of Kerry, with the bordering parts of the counties of Limerick and Cork, and the western part of the county of Galway; and I have since visited the improvements made by Messieurs Bradshaw and Roscoe in this country, and also several in Holland, Flanders, and Westphalia.

Did you possess any facilities for seeing the works executed in Holland?—I was recommended by our ambassador to the director general of the water-staat, who is the minister having the direction of all the public works of drainage, roads, and navigation there; I was shown liberally the plans in his office, recommended generally to the Dutch engineers, and particularly to the superintendent of drainage, by whom I was carried over some of the chief works of that description, and of which I have plans; the engineers of that country were very liberal in their communications.

Did you examine into the result of the execution of any of those works?—I did, of several; and particularly that of Zevenhoven, &c. about 20 square miles in extent, and in cultivation, when I saw it. The greater part is 18 feet below the low-water mark of the ocean; the soil is bog, exactly the same as the Irish, the under-stratum

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marly sand, the original depth of peat, from 12 to above 20 feet. I have also seen a great deal of the process of draining in Flanders and Westphalia.

Will you furnish the Committee with the detail of your observations on the process employed for draining and improving the bog above mentioned, and other bogs you have turned your attention to on the continent; and as far as you are able, the heads of expense attendant upon it, with the comparison of the expenses which would have attended a similar drainage of the bogs in Ireland, and the grounds on which you would form such a comparison?—I will, so far as the notes which I have in town, will enable me.

Have you turned your attention to the provisions that might be requisite for the formation of a general drainage bill, and on what principles would you recommend such an act to be constructed?—I have drawn up the heads of a bill on the precedent of the general Inclosure Act of 1801; it is in the hands of Mr. Secretary Grant; I think, however, it might be desirable to make some particular regulations in addition, especially on the subject of drainage.

Have you had opportunities of seeing the wastes and bogs in the other parts of Ireland?—In the course of my professional engagements, I have had occasion to visit nearly all the bog and waste tracts of Leinster, Connaught, and Munster; I am very little acquainted with Ulster.

Have you found in those tracts of country, large quantities of improvable land very inaccessible in their present condition?—The western parts of Donegal, Sligo, Mayo, Galway, Kerry and Cork, are mountainous districts, into which there are few or no roads practicable for carriages; the formation of such roads for transporting manure and produce, is the chief means of improvement, which I and my brother engineers employed on the bogs, have recommended for those districts.

Have you found in those districts many valuable harbours?—The best natural harbours in Ireland are in those districts, but they are in general little used for the purpose of commerce.

Are those harbours nearly unavailable in their present state, for import or export of the produce of the country?—They are chiefly useful to the fishermen who inhabit their banks, whose numbers are very great, but of small avail for import and export, from the want of wharfs and landing places, or of roads to them, through the mountainous and boggy tracts on their shores.

Are not the fisheries considerably discouraged by the difficulty of passage through the adjoining country?—They are so; for instance, the Killery harbour, which has an excellent fishery, is within nine miles of the thriving town of Westport; there is no road to that harbour fit for carriages, nor any road at all along either shore.

Is that the general case of the harbours lying on the coast of the mountain district?—It is very much the case.

Have the Scotch fisheries been materially promoted by opening lines of road to the harbours where they are carried on?—That was the chief object of most of those roads.

Were those roads you speak of in Scotland constructed in any part at the public expense?—The parliamentary commissioners have granted one-half of the estimated expense of every road, the other half is defrayed by assessments on the proprietors of the whole county, where the county have agreed to the roads, or by the private subscriptions of those interested in other cases, and the engineering and superintendence of these roads are defrayed entirely by government; but for this subject, I must refer you to the parliamentary reports.

Have you had an opportunity of examining the execution of those public works in Scotland?—I have, but not within these last seven years.

Did it appear to you, that the works had contributed much to the improvement of the country generally?—The habits of industry and skill which those works introduced, have been of considerable service; but few of them were so far completed when I left that country, as to enable me to judge of the effect; Mr. Telford, who has superintended those roads, can give better information on the subject.

Does the coast of the mountain districts of Ireland, compared with Scotland, contain much valuable manure for agricultural purposes?—The mountain tracts in Ireland of which I have spoken, are vastly superior in their capability for improvement to any part of the western highlands of Scotland, in point of soil, climate, elevation and nearness of market, provided they were accessible. With respect to manures, they are similarly circumstanced; shell-sand and sea-weed equally abounding, and these manures are in many cases carried on horseback many miles into the interior; and on the farms along the shore, they are chiefly carried in baskets on the

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backs of men and women, but I have never seen a wheel carriage employed for that object, owing to the want of roads. Limestone is more abundant in the Irish than in the Scotch highlands.

Are those manures peculiarly applicable to the improvement of the mountain districts?—In my opinion, these are the best manures for that purpose, as the improvement of the bog and mountain on these coasts has been carried further than on any part of the interior.

Are those districts populous?—The population of the sea coast is very great, but the interior of the mountain tracts is mostly desert, until you arrive back at the cultivated plains.

Do the inhabitants wander much about the country to obtain work?—The chief resource the inhabitants of the coast have is fishing; they are in a great degree unemployed.

In Connaught there are no public works to which they can apply; in Munster the poor labourers from Kerry, Cork, &c. come frequently to the works at Dunmore near Waterford, upwards of 100 miles, but the limited number of the workmen there, and the claims of the distressed population of the neighbourhood, prevent their obtaining much relief from that undertaking. At all times however, a great many poor labourers from these mountain districts, are in the habit of wandering in search of employment in the common operations of agriculture or otherwise. On the least encouragement, several thousand of these labourers appear in search of employment at any public work.

Martis, 11° die Maij.

DO you know what proportion the highlands of Scotland bear to the entire contents of Scotland?—They are at least one-half the area, and contain one-sixth of the population.

Are the seats of the fisheries chiefly in the mountain districts?—The most valuable fishings are in the mountain districts of the west coast; but the inhabitants of the east coast, which is better cultivated and nearer the market, have hitherto prosecuted the fishery with most success.

What proportion do the mountain tracts of Ireland, bear to the whole of the island?—About one-fourth of the area; the whole area of Ireland is about 12,000,000 Irish acres, of which 2,000,000 are bog, and 1,500,000 uncultivated mountain.

How much of the uncultivated tract might be cultivated?—About one-half, but the whole of it is fit for plantation.

Veneris, 14° die Maij.

BY the half which may be improved (as stated in a former examination,) for cultivation, do you mean that it might be laid under the plough?—Under the spade, under tillage, fit for conversion to arable land, by the plough or the spade.

Could the remainder be materially improved for pasturage?—Decidedly, by draining and liming.

Will you state to the Committee, the particular district of sea-coasts on which fisheries can be carried on, which have come under your notice, and where you consider the establishment of new roads, and improvements of old lines of road, to be essentially necessary to the furtherance of such establishments?—The first great tract of mountain country of that description, and well suited for the fishery on the west coast of Connaught, with which I am acquainted, is the peninsula between Killalla Bay and Newport, in the county of Mayo, commonly called Erris; the next the peninsular tract between Westport and Galway, beyond Lough Corrib, called Morisk and Conamara; the third the barony of Burren, in Clare; fourth, the peninsulas of Corlnaguiny, Iveragh, and Bantry, in Kerry and Cork.

Are you acquainted with the state of the fisheries of Ireland, on the coast?—Not very accurately.

Do those districts which you have named, stand much in need of improvement, with respect to roads?—This is so much the case, that in the first two districts, the grand jury of Mayo have borrowed from the commissioners for loans, considerable sums, in anticipation of their presentments for making two roads into Erris and to the Killery harbour. In Galway and Clare nothing of that kind has yet been proposed, from the gentlemen not yet being aware of the powers of doing so. In Kerry, application has also been made for a road into the peninsula of Iveragh, and others are intended; many more roads would probably be undertaken, were those powers continued, or other more accessible funds provided.

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Are not the principal of these sums to be repaid by instalments, with interest thereon, by the counties?—They are, under the act of last session, which empowers grand juries to borrow.

Do you know whether the expense of such repayment is incurred by the mountain districts through which the roads are carried?—I believe Erris and Killery roads are by the county at large, I think those two; the Mayo roads are by the county at large, the Kerry road partly by the barony.

Is not the forming and gravelling of all the Kerry road, levied on the barony?—Yes, the masonry is defrayed by the county.

Is there a great population in those districts you have mentioned?—Along the shores chiefly, the population is very great.

Does the fishery in those districts appear to be conducted upon a judicious principle?—The chief part of the capital of the poor people there is employed in the fishery, but their boats are certainly very imperfect; the boats of Mayo and Galway are half-decked hookers, those of Clare are chiefly made of wicker and hides, and in Kerry they have only yawls.

What kind of fishery is off that coast?—The coast of Galway and Mayo abounds peculiarly in mackerel and turbot; they also pursue the sun-fish to a great extent, but at much risk, in consequence of the inferiority of their vessels for that stormy sea; towards the South gurnet, soles and hake, are the chief; cod is general over all.

Do you mean to say, that upon that extensive coast mackerel and turbot are the principal fish taken?—I think they are the chief fish pursued on that coast, except cod?—Are you aware that an extensive fishery could be made beneficial to the people of the country, beyond the mere market of the day?—Mackerel is not cured; but turbot is sent from Galway to Dublin; and those of Erris would also, if it were practicable; the turbot of Galway and cod come across the Shannon, and are sold in Tipperary and neighbouring counties.

Do you think that the fishermen confine their efforts to near the shore?—In the south they do, excepting about Kinsale.

Is there a valuable sun-fishery pursued on the coast of Galway and Mayo?—Yes.

Are you aware of any oil being sent to London, obtained from that source?—Not personally; I have heard so.

Do you not consider that the fisheries on the coast would admit of considerable improvement?—I have no doubt that they would.

Have you any reason to suppose, from any thing you have heard, that there is a very extensive cod fishery which might be made available on the coast of Ireland?—I have understood that there is a very extensive range of cod banks on the western coast of Ireland, especially off the Isle of Ennisbofin; but I am very little acquainted with this subject; I know along the coast of Waterford there are no boats fit for fishing; they have no harbours to hold such boats; they must have boats to draw up on the dry land; but on the western side of Ireland nature has provided harbours in which the hookers lay afloat.

Do you consider that the fishery is declining on the western coast of Ireland?—Indeed I am very little acquainted with the fishery of Ireland. I think I can give but very little information upon that subject; I understand that the herring fishery was very valuable some years ago on both sides of Ireland, but it failed. We had last year, in the neighbourhood of Waterford, a good quantity of herrings, and an immense quantity of sprats and mackerel. At the works at Dunmore I have seen two or three hundred people standing in an evening fishing for mackerel with rod and line; I mention this only to show their abundance.

Do you conceive that the fisheries on the coast you have mentioned would be very materially encouraged, by opening improved lines of road into the interior of the country?—It would, from the superior facility of access to the market.

Do you not conceive, independently of the facility of access which these roads would give for that purpose, that it would be of great general benefit, by opening those places to other parts of the country?—Yes, and converting those places to agriculture, much more than by any thing else.

That agriculture, as well as the fisheries, would be materially improved by such lines of road?—The truth is, the only encouragement to agricultural pursuits in Mayo, is by the conversion of the grain into whiskey; for this is the only shape, I might almost say, in which the agricultural produce of the country can be carried out, it being necessarily conveyed on horseback.

You mean to say, that in the present state of the country there is no other profitable mode of applying the produce of the land, but by making it into whiskey?—No; in the southern

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southern mountainous tracts in Kerry and Cork, there is no distillation of illicit whiskey carrying on; the ground is there under pasturage, and the produce chiefly butter, which is universally carried out on the backs of horses; these other tracts of which I have been speaking, make no butter; there is only cattle for breeding; there is a good deal of that kind of stock sent out, and also many pigs.

In your opinion, would the construction of carriage roads lead to the sending of grain to market?—Yes; I have no doubt that it would be the means of converting the countries of Erris, Morisk and Conamara, into grain countries; roads have within these last thirty years had that effect in the plains of Mayo; at this moment these plains constitute one of the most fertile districts in Ireland, and which is evident from the exports of the port of Westport, which have amounted to many thousands a year.

Generally speaking, is not the grain in that district cheaper than in other parts of the country?—Yes.

To what do you attribute that increase of cultivation?—The chief cause was, I believe, the great encouragement of the late lord Sligo, and the ready market given by some merchants settling in Westport.

The Committee understand, that you are extremely well acquainted with the state of the bogs and wastes in the interior of Ireland?—From travelling over them only, not from any actual survey, except what is accessible to every body else, the general bog reports.

Do you not consider, that the application of capital and enterprize to reclaiming these districts, would be a very extensive means of employment to the population?—Yes, I conceive so, and also a very profitable application of capital.

Are not these tracts very populous, and the population in a state of great poverty and distress?—There are many tracts of Ireland where the population amounts to one person to every two acres of surface; in the county of Louth you have a whole family on two acres.

Would the labour applicable to such improvements be in a great proportion manual labour?—Almost entirely; horse labour can be very little used in bogs.

Have not the mode and manner of conducting such works been very accurately considered by the engineers employed under the commissioners; the mode of executing the drainage of bogs, and the reclaiming of the soil?—The reports of the engineers have been chiefly guided by the operations which have been already performed, supposed to be improved in such manner as their superior acquaintance with the modes of facilitating labour enabled them to suggest.

Do you consider that the improvement of the tracts would be likely to afford a permanent source of employment to the people afterwards?—The improvement of the bogs and waste, would provide for an additional agricultural population of two millions.

What is your opinion, with respect to the operation of the Loan Act, passed the last year; do you think it has at all answered its object?—I am one of the engineers of the loan commissioners, and would rather be excused at present from answering this question.

Do you consider that the adoption of a general drainage act, as the foundation of particular acts, applicable to separate districts, would very much facilitate the employment of the poor, and the improvement of the country?—I think it would very much facilitate that object, and especially if some means were provided for valuing the interests which at present tend to restrict the improvement, although not in themselves applicable to any profitable purpose.

Are you aware of large districts of very valuable soil at present requiring drainage, in Ireland?—The banks of almost all the rivers are liable to be overflowed, and yet they form the finest pastures in that kingdom, very few of them have been as yet embanked.

Do you know of large districts of rich soil which are inundated?—There are some extensive tracts of that kind, especially on the Shannon.

Very extensive?—Yes; it was thought by Mr. Jessop, the engineer, that many thousand acres of land could be got by lowering the rocks at Killaloe, on the Shannon.

Do you suppose that the want of such laws as exist in England, respecting drainage, is not a great impediment to improvements in Ireland?—It certainly is a great impediment; there are no laws calculated to procure any co-operation; what laws are applicable to Ireland, in many instances, are not suited to Irish property.

What progress is now making in the reclaiming of bogs in Ireland?—The reclaiming

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ing of the bogs has been a good deal hastened apparently by the printing of the bog reports; many extensive works in the way of embankment, navigation and drainage, have been begun in different parts of the country, but yet with a very partial effect; much good probably would be done by the publication of those reports, for I find many proprietors extremely anxious to get possession of them, which can be only done by an order of the House itself.

[The following Papers were delivered in, and read:]

Some Account of the Drainages of Holland, &c.

By Mr. *Alexander Nimmo,* F. R. S. Ed. Civil Engineer.

IN order to have a correct idea of the works of drainage in the low countries, it is necessary to take a view of the physicial position of that interesting portion of Europe.

We may perceive, even by the map, that the northern part of Germany is an immense plain, descending gently towards the north sea, near which every thing like high land disappears, there being no considerable mountain within 150 miles of the coast; and from Calais to the coast of Denmark, the shore exhibits chiefly a range of low sand hills or downs, here and there broken so as to admit the exit of the land waters of the great plain aforesaid.

It is probable that these downs owe their formation to the action of the sea, which has very little rise and fall on the shores of Holland and Denmark; these countries being situated so as to be little affected either by the tide of the north sea, or that of the English channel. Behind this range of downs, which seldom exceeds a mile in breadth, lies a shallow bason, chiefly occupied with peat, bog or morass, the surface of which is but little above the mean level of the sea, and the bottom from 10 to 20 feet below it. The breadth of this space varies frequently, the outline of the dry lands of the interior being much more irregular than the shore of the ocean. It is broadest in Holland and Friesland, where the great inlet of the Zuyder Zee still exists unfilled with peat; and, according to tradition, was formerly a lake only, until the Cimbrian deluge, breaking the northern boundary of the morass, had admitted the ocean into Friesland.

It may be observed, that the continuous part of the morass is chiefly in the neighbourhood of the great rivers, the Rhine, the Meuse, and the Scheldt. It is the nature of all rivers, liable to inundation, to deposit a great part of their sullage on the immediate bank, which thus rises more rapidly than the morass behind; this kind of natural embankment has in every country produced a slip of land, on each side of a great river, of extraordinary fertility, and great value to a pastoral people. It may have first suggested the idea of completing and extending the work, by embanking the rivers, and securing the meadows by dikes. The embankment of the Rhine, at least of the great island of the Betrume, is more ancient than the invasion of Cæsar; but the greater part of the works of that kind date from the middle of the twelfth century, and appear to have been suggested by the crusaders, after seeing the works of the Delta in Egypt. Various tracts of Holland were formed into waterships or districts of drainage, and regulated by corporations consisting chiefly of the landed proprietors, which system continued until the late formation of the Batavian republic. The works executed by these corporations, for the purpose of drainage and navigation, are truly astonishing; they are supposed by able judges to have cost at least three hundred millions sterling; and yet the whole country is not larger than Wales or Munster.

The most remarkable event in the history of the drainage of Holland is the invention of the windmill, about three centuries ago. By means of that instrument, the system of drainage has been extended to those morasses and lakes, which were already as low as the sea or neighbouring watercourses. In fact, a great part of that singular country is placed at a lower level than the neighbouring ocean, and kept dry by artificial means alone. Such tracts are called polders; they are surrounded by banks, over which their waters are lifted by windmills. Successive operations have carried this so far, that some of the lately drained polders are even 18 feet below the ordinary low-water of the Meuse or Ye. When to this we add the height of the interior rivers, which are embanked in some instances as high as 24 feet, the situation of that country appears truly critical.

On the setting in of winter, drainage ceases; the meadows are converted into a sea of ice; but, provided the rivers are secure, a short period of the spring is sufficient to clear all the proper waters of the polders. The mills are not wanted

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more than 30 days at an average during the whole year; each mill is equal to the drainage of 600 acres; the whole throwing to the height of four feet 700 barrels of water (each 5¼ cubic feet Rhineland) per minute.

Besides the natural lakes which pervade Holland, the watery surface is constantly extending by the process of cutting turf for fuel, which reaching to the depth of 12 to 20 feet below low-water, leaves the country from which it is extracted in the state of a lake interspersed with numerous isles of turf. These sheets of water, named "plassen" or "plashes," are all on one level within certain districts, and communicating with the canals, are pervaded by boats navigating by the sail or perch. But as many of these plashes, uniting together, form great lakes, having waves, which act upon and corrode the neighbouring lands, it is part of the policy of the Dutch to have them drained and cultivated; permission, therefore, is not given to cut turf in this way until a certain deposit is made in the hands of the state. But this fund, however adequate it may have been in former times, is now far too small for defraying the expense of drainage; it forms a portion of the national debt, and is payable to any person or company who will undertake the drainage. About 150 years ago, nearly all the lakes of North Holland (containing about 80,000 English acres) were reclaimed by private companies as a profitable speculation; but of late the great works of this kind have been chiefly undertaken by the state; the land-owners in most cases agreeing to surrender their claims. The lake is surrounded by a dyke of a particular construction, to keep out the foreign waters, and on the outside a surrounding drain is made of sufficient dimensions to be a navigable canal; the interior water is then elevated into this canal by means of windmills, and passes thereby to the ocean. When the polder is drained, the remaining turf is sold for fuel, retaining a certain portion to form a soil which of course is similar to the "cut away bog" or "mooreen" of Ireland. The ground is then tilled and sown with rape, which is sold on the spot by auction, as is also the hay on the roads, dikes, &c.; and sometimes a second crop is taken ere it be laid down with clover; the lands are then divided into kavels or lots and sold to the best bidder, subject to all the expense of supporting the drainage, as also to the usual taxes on land, cattle, salt and the like, from which, for a term of years at least, those lands reclaimed by private adventurers were usually exempted.

One of the latest works of this kind is the drainage of Nieuwenkoop and Zevenboven, completed in 1812; it extends over 20,000 English acres, and cost £.300,000 sterling, of which sum the sales only returned one half, but the state considers itself amply paid by the taxes arising from the newly gained land, and the cessation of the damage formerly caused by the lake.

The neighbouring drainage of Mydrecht has already cost a million of guilders or £.100,000, and is still incomplete. The steam engine has been employed there with partial success.

These drained countries in Holland are found to be very productive; and though originally acquired and supported at an expense vastly greater than is necessary in bogs or marshes, which are level free. Yet the drainage charge seldom exceeds four guilders per acre per annum; and such is the security felt, that houses and farm buildings are erected and inhabited, and capital invested in them, without scruple.

Their greatest advantage is the perfect command which they have of the water, the height of which, from the general flatness of the polder, may be and is regulated to an inch; the millers throwing off the waters whenever they rise, and drawing down from the canals whenever there is a drought.

Where the Dutch have not this convenience, they do not seem to be versant in the cultivation of turf bog, though a good deal has been reclaimed on upper ground also, especially in the eastern provinces. The polders of Holland, though they have given abundant crops of every kind, are for the most part kept in permanent pasture.

Short Account of the Drainage of the Fens in England;
by Mr. *Alexander Nimmo*, Engineer.

UNTIL the latter part of the reign of queen Elizabeth, the business of drainage was in this kingdom intrusted to the management of local commissioners of sewers, whose powers were partly regulated by the custom of Romney Marsh, partly various temporary statutes, and in the reign of Henry VIII, by a general law, on which they still proceed.

The objects of these commissioners, as may be seen by the law of sewers, and form of the commission, 6 Henry VI, was not the investigation of new improvements or means of relief, but the preservation of ancient channels and banks, and the discovery of the persons whose duty it was to uphold the same. These commis-

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sioners are appointed for a term of years by the chancellor, &c.; their form of proceeding is by the summoning a jury, to inquire into nuisances, and present for their removal.

No great work of drainage could properly be undertaken by their authority; what had been previously done, was chiefly the work of the various religious houses to whom we owe so many agricultural improvements, and on their dissolution by Henry VIII, it is probable many of these improvements fell into decay.

But at the period alluded to, sundry adventurers from Holland, and especially the English officers, who during their services in the wars of the low countries, had witnessed the success of many great works of that kind, and had become well acquainted with the practice thereof, introduced a new system of proceeding, and proposed to undertake the recovery and drainage of great tracts of land on a regular plan, and as a profitable adventure. One of the first adventurers of this sort, of whom we find mention, was captain Thomas Lovell, who undertook the drainage of Deeping Fens; he is represented in the petition from Deeping and other neighbouring towns, as "a man skilful in like works, wherein he had beyond the seas been much used and employed;" 41 Eliz. He was to have executed the undertaking in five years, and to have one-third of the fens for his trouble, but probably failed from want of capital, for in his petition, 1 Jac. he states, that his whole fortune of £. 12,000 was expended in this undertaking, and it was after all imperfect.

This, however, seems to have been the commencement of the grand project for draining the fens; the commission granted about twenty years before, for inquiring into the plan for a new outfall drain for the fens by Clows Cross, having been only a partial measure, and nothing effected in consequence of it.

In 43 Eliz. a *general Drainage Act* was passed for the recovery of many thousand acres of marshes and other grounds subject commonly to surrounding waters, within the isle of Ely and the counties of Cambridge, Huntingdon, Northampton, Lincoln, Norfolk, Suffolk, Sussex, Essex, Kent, and the county palatine of Durham. In this Act, it is stated, "that the chief obstacle to the recovery of such grounds by skilful and able undertakers, is, that the greater part of them are wastes and commons, the rights to which could not be extinguished by common law, nor could the commoners pay their part of the charges of recovery;" a power was therefore given to the owners and majority of commoners, to make contracts for the recovery with undertakers, and to convey to them a part of such lands (except crown lands, without the royal assent) as might be agreed on by way of reimbursement.

Soon after the accession of James I, the business of a general drainage was taken up more earnestly; the king expressed his willingness that the crown lands should contribute as others, and appointed Henry Totnall and John Hunt to view the fens, and agree with as many lords and commoners as they might, and the commissioners of sewers of the various counties, were directed to assist them. Mr. Richard Atkins, of Outwell, was employed to bore over the level to the depth of eleven feet, in the line of the proposed works; and W. Hayward made a survey of the fens, by which the contents appeared to be 307,242 acres. This general drainage was reported by the commissioners to be feasible, and after a particular survey of the various water courses, which appear then to have been very defective. The great features of his plan, were explained by Hunt, the artist for the drainage; viz. to cut straight courses for the rivers Ouze and Nen to Salterslode, where the river Ouze, at low water, was found to be ten feet below the soil of the fen, and to turn the rivers into these courses, by sluices at the beginning of the new cuts. These works, or nearly the same, have since been executed: 13th July 1605, Sir John Popham, lord chief justice; Sir Robert Fleming, chief baron of the exchequer; Sir Wm. Rumney, alderman; and John Eldred, citizen and clothworker of London, were declared the undertakers of the drainage of all the fens between Ouze and Deeping, and to have 130,000 acres for their portion. From want of skill in the engineers, or other causes, the success of this first company was not great. On the 5th of August, Hunt and Atkins laid out the new channel for the Neo called Popham's Eau; it was opened 21st of December, to Upwell, but in March following broke its banks, and had to be stopped. In 1606, a bill was brought into parliament, for regulating the drainage, which however under the authority of the commissioners, proceeded slowly; 1609 Popham's Eau was enlarged; 1611 a channel was laid out, and made, by Hunt, for the drainage of Coldham and Waltersey, a separate but subordinate undertaking, the waters from which passed by a tunnel or pipe under the Welle river, and thence along the edge of Marshland; to the Ouze at Stowbridge; at laying the sluice at Stowbridge, the coffer dams were

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repeatedly burst. In 1630, a very high tide occurring, broke the dikes of Marshland, and laid the district under water, doing damage to the extent of £.40,000; this tract is situated between the fens and the sea, and strenuous efforts were now made to have the various outlets to sea first deepened, ere the water should be brought from the fens. The commissioners were also annoyed by vexatious suits, so that little progress was for some years made in the general scheme of drainage, and even the scouring of the old channels was obstructed by the diversity of opinions. The commissioners were relieved from these vexatious suits, by orders of council, their powers to make new drains ascertained, and on their petition, Sir Clement Edmunds was deputed by the privy council, to examine the various outfalls of the rivers, and report thereon. The result of this was a proposal from Sir Wm. Ayloffe, Anthony Thomas, and others, to undertake the work on new conditions, but after much negotiation about the terms, the project fell to the ground; and though the king being earnestly bent on the work, declared himself the principal undertaker, yet from various political difficulties, no further progress was made during that reign.

But in the early part of the reign of Charles I the business of drainage was again resumed with more appearance of success; artists were brought from Holland, where at that time several surprising works of the kind had just been effected, and many more were in hand. Cornelius Vermuyden's first work in England was the embankment of Dagenham Marshes, for which he had a part of the lands assigned to him, and confirmed by patent in 1621. In 1626 he undertook the drainage of the fens in Hatfield Chase, &c. between the Trent and Ouse in Yorkshire, and effected the same in five years, at an expense of £.55,825, for which he had one third of the lands assigned him, and a colony of foreign protestants settled thereon. In the same year (1626) he proposed a plan for effecting the drainage of the great level, upon 95,000 acres being assigned to him; but the country objecting to deal with an alien, applied to Francis Earl of Bedford, one of the chief proprietors of the fens, who, with certain other adventurers, undertook the work on the same terms. This company were incorporated, 10 Car. I, and executed sundry cuts for the Welland, Nen, and Ouse, having in about three years expended about £.100,000; but though the country was thereby much relieved in summer, it was still liable to winter floods, and the drainage being therefore considered as imperfect, 40,000 acres only were allotted to the adventurers.

In 1638 the King took on himself the completion of the drainage, both of Deeping Fen and the Great Level, and after procuring sundry reports on the subject from various qualified persons, of whom, Sir Cornelius Vermuyden, was the most remarkable, a system of embankments was resolved on, with broad washes on the sides of the principal drains, to contain and take off the flood waters. For this undertaking the King was to have allotted half the portion of the former adventurers, and an additional 57,000 acres for the Bedford Level, 12,000 acres for Deeping Fen, and 35,000 acres for other marshes and fens in Holland and Marshland. Under this agreement sundry works were executed, until the prosecution of the undertaking was interrupted by the civil wars. In the mean time several other companies had undertaken the drainage of the fens round Boston; so that on the whole the greater part of the marshes of England were now in the way of being recovered; but during the troubles which succeeded, the country people in many cases took forcible possession, and the banks drains and sluices were suffered to fall into decay.

In 1649 the claims of the adventurers of Bedford Level were revived; and having obtained the sanction of Parliament, for proceeding on their original contract, they, in 1653, completed this work. Their proceedings were ratified and confirmed by an act of parliament, 15 Charles II. The adventurers made a corporation, the several lands allotted to them, subject to the expense of keeping up the works, &c. as may be particularly seen in Cole's Collection of the Laws of Bedford Level, which may be also consulted for a variety of particular arrangements, which it is unnecessary now to detail.

Sabbati,
15° die Maij.

Mr. Robert Fraser

Mr. *Robert Fraser*, called in; and Examined.

ARE you generally acquainted with the western coast of Ireland?—Not personally; but I have received a good deal of information from the Irish fishermen, who have been accustomed to go there from Dublin.

Do you estimate the Skerries fishermen, from the neighbourhood of Dublin, the best fishermen?—Yes, the best.

They fish extensively on the west of Ireland sometimes?—Yes; and they also

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were formerly accustomed to fish upon the coast of Scotland, even off the Shetland Isles.

From the information they gave you, do you conceive there is any extensive cod fishery on the western coast of Ireland?—I know there is an extensive cod and ling fishery in Bantry Bay; and by the late captain Huddart I was informed, that he found a bank for cod extending along the whole of the western coast of Ireland, and the western coast of the Hebrides; and it was his opinion, that it extended to the Faroe Islands of Iceland.

Has any bank been sounded there?—Captain Huddart sounded the banks, and found they were about 38 fathom deep, similar to the banks on the south of Ireland.

Did you hear the distance of this bank from the western coast, the general run of it?—About 20 leagues.

From the coast of Ireland?—Yes.

Do you not consider, that if the Skerries fishermen from the eastern coast north of Dublin found it worth there while to go to the west, there would be much more advantage to the establishment of the fisheries on the immediate coast?—Most certainly.

Do you consider, that the nature of the fishery laws produce some difficulties in the way of the establishment of the fisheries?—I am not acquainted with the fishery act at present proposed in Ireland; but Mr. Peel sent me, last year, a copy of the amended act, which he had brought into the House, for the encouragement of the Irish fisheries, in which he very properly brought in a clause for granting the bounty of 4*s.* a barrel upon the herrings, in order to place the Irish upon the same footing as the people of Great Britain.

You are aware, that under the present laws, the bounty is confined to 20 ton vessels; do you not consider that a much more direct encouragement to the small fishermen of the coast could be given?—I conceive it would be of great importance that such a regulation should be made, that they should have salt duty free for their fisheries, limiting it to boats carrying 12 tons.

Do you not consider, that independent of the amount of duty, that the various regulations to enable them to get the drawback on salt, are extremely inconvenient and discouraging to the lower class of fishermen?—The lower class of fishermen are not able to comply with the terms of obtaining the drawback.

Some discouragement has been thrown upon the fishery interest by the disappearance of the herrings from the bays; do you not consider, that the deep sea fishery is independent of those casual appearances and disappearances of herrings, which happen immediately on the coast?—Most certainly, and the fish seem to approach the coast from the deep sea, for the purpose of depositing their spawn in the shallow grounds.

Which are the nearest fishing banks to the coast of Ireland?—The Nymph Bank, and the whole of that bank that we suppose surrounds Ireland, like a horse-shoe, proceeding along the south and west.

How far is that from the coast?—Fourteen leagues from the coast I have found fish; but the investigation could not be said to be made very perfectly by captain Huddart.

Are the ports of Ireland, which are nearest the Nymph Bank, convenient for the fishery on that bank?—Extremely convenient; Waterford and Dungarvan.

Do you think, that the fishery on the Nymph Bank might be as advantageous or more so than any other fishery on the coast of Ireland?—That is a question I cannot answer, because I am not thoroughly acquainted with the fisheries in the west of Ireland, and the south-west, where I understand there is great abundance of both cod and ling in the large bays, into which that coast is divided.

Do you know of any advantageous bank for fishing on the eastern coast of Ireland, between the bay of Waterford and the city of Dublin?—There is no extensive bank that I know of, but there is a great abundance of fish off the bay of Wexford; there is also a considerable fishery off Arklow; the herrings resort to the bay of Wexford and Arklow every year.

Do you think it would be advantageous to establish fishing villages along the coast of the counties of Wexford and Wicklow?—I consider it would be extremely beneficial for the purpose of bringing the fishermen, who are living in detached situations, into those villages, where their joint labour might be employed in the fisheries, and likewise separating them from their small farms.

Do you not consider the mixing up the employment of farming and fishing as a great

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great objection?—I consider it a very great one; but I see no objection in the infancy of a fishing village, that they should have ground for planting potatoes.

What situations do you consider most advantageous for fishing villages?—I consider the Grey Stones in the county of Wicklow, about three miles from Bray, to be the best situation in the northern part of the county of Wicklow; I consider the mouth of the bay of Wexford, and across Faranogue, on the bay of Ballatigue, to be the best situations on the coast of the county of Wexford; Arklow, also, in the county of Wicklow, might be greatly improved as a fishing station.

Do you not think the bay of Fethard, also, might be made a fishing station?—There are several stations on the coast of Waterford, particularly at a place called Dunabraton, about ten miles on the east side of Dungarvan, between Waterford and Dungarvan, and various other stations might be found extremely eligible upon more attentive examination.

Do you not consider some more direct and immediate encouragement to the small fishermen on the coast, is absolutely necessary to any important extension of the fisheries?—I consider that a bounty upon the barrel of fish, or the hundred weight of cod, as now granted in Scotland to the boat fishery, would have the most beneficial effect in encouraging the boat fishery in Ireland.

Is the chief control of the fisheries in Scotland in the customs?—No, there are commissioners for the fisheries.

Who pays the bounties?—The excise; but they have no control over them.

They have officers to watch the fishing?—The commissioners appoint officers.

How is the bounty drawn for?—The bounty is drawn for by a certificate from the board of fishery commissioners, and the receiver general of excise pays it.

Do you not consider that depôts of salt on convenient parts of the coast, would also be a very necessary measure to the encouragement of the boat fishery?—It would be a measure of very great importance to the boat fishery.

Do not the boats find it necessary, when they go out eighteen miles, to salt the fish at sea?—Certainly.

How could they have an opportunity of salting the fish in those open boats?—It would not answer in the open boats, the fish must be brought on shore.

Have you been in Scotland since the establishment of the new regulations?—Yes; I recently came from Scotland.

Do you consider the opening the roads to the coast has been attended with much advantage to the market?—Most certainly, the improvement of the fisheries, and every other thing in Scotland, has been most materially advanced by the parliamentary commissioners for making roads and bridges.

It has contributed both to the improvement of the country, and the extensions of the fisheries?—It has tended towards both; from the northern parts of Scotland the herrings are generally carried by sea to the Firth of Forth, where they are generally exported, and not by land.

Do you not consider, that opening the sea-coast to the interior of the country, and vice versa, opening the country to the fisheries, would be attended with great encouragement to the fisheries in the case of Ireland?—Most certainly beneficial, not only to the fisheries, but for carrying manure from the sea-coast, as upon all parts of the sea coast of Ireland there is a vast quantity of shell sand.

Do you not consider that to be one of the first steps towards the improvement of the country, or the establishment of fisheries?—Most certainly.

Martis, 18° die Maij.
Mr. Telford.

Thomas Telford, Esquire, called in, and Examined.

YOU have not been much over Ireland?—I have been over a part of it; I have been on the eastern side of the island, between Waterford and Belfast, but not on the western parts.

The Committee are desirous of asking you generally, with respect to the Highlands and western parts of Scotland, whether from the opening of the lines of communication to the coast, any considerable advantage has resulted to the fisheries?—No doubt there has; but a sufficient time has not yet elapsed to produce the full effect. There have been made, under the parliamentary commission, about 1,000 miles of road, and about 1,500 bridges, besides a very considerable number of harbours, landing-piers and ferry-piers.

Has there not been considerable progress made in the fishery in consequence of these improvements?—The fishing stations have been rendered much more accessible by land, and both the north and eastern coasts are in consequence more immediately connected with the western fishing-lochs.

Throughout the country the communication is now much facilitated?—Yes, very much so; formerly, there being very mountainous and inaccessible countries between the fishing stations, when the fish appeared on the western coast, the fishers on the eastern coast could not in bad weather cross the country; and proceeding by sea were often so interrupted by contrary winds and bad weather, that the fish were gone before they reached the place, or could get satisfactory information as to the state of the fish upon that part of the coast; this is essentially necessary to those who are engaged in the fisheries, because they keep up a correspondence with their employers, and these employers reside chiefly in the south-western and south-eastern parts of Scotland, at a very considerable distance from the fishing-grounds on the northern and western coasts; that is to say, in the towns situated on the Firth of Forth, the Firth of Tay, also Leith and Dunbar on the eastern sides, and Greenock, Campbeltown and Rothsay, on the western side of the island.

In what state were the fisheries on the coast of the Highlands previous to the measures adopted under the commissioners?—By the fisheries on the coast of the Highlands, I presume is meant chiefly the herring fishery?—Yes.—With regard to the western coast, the herring fishery, for many years previous to the road-making, had failed very considerably, the fish did not appear on the coast. For the last two years the fishing has considerably improved on the western coast; but the steadiest fishing on the coasts of Scotland, for 30 years past, to my personal knowledge, is at the north-eastern coast of the Highlands, along the coasts of Caithness.

That is what you call the Highland fishery?—Yes, off the coast of Caithness; this has been gradually improving during the last twenty years, and more especially so since the new roads have been opened on the whole of the north-eastern coast of Scotland, which have rendered it accessible to the fishers who reside on the south-eastern parts, which I have already named. During the last two years, and especially the last, the fisheries have been found to succeed along the whole of the north-eastern coast, from Aberdeen to the Orkneys. I last year, on my progress through the country on the business of the parliamentary commissioners, found every inlet covered with fish, and herrings packed in barrels. The Caledonian Canal and the new roads, have opened access for a supply of herring barrels; the extensive forests of birch which are to be found in almost every valley in the north of Scotland, were formerly of no value, and applied to no use, but it is now found that they are very fit for herring barrels. This has been of great advantage to those concerned in the fisheries, as well as to the proprietors of the forests.

The roads then have led to the improvement of the fisheries?—Yes, they have gone hand in hand, now that good roads are accessible by carriages to the extremities of Scotland; previous to these roads being made, unless a man went by sea, he could have had little or no communication with the fishing stations.

Do you not consider, however favourable the natural situation of the coast is for fisheries, they could not have extended to any considerable degree but by the application of capital from other parts of the country?—I am decidedly of that opinion; the fisheries are carried on chiefly by persons from the southern parts of Scotland.

Has the opening of the coast, to the interior, had much tendency to improve the country?—Very considerable, which the Committee will be aware of, when I explain that the people before these improvements took place, had no beneficial object to exercise their industry upon; in the course of opening these roads, and constructing the Caledonian Canal, to which I have been engineer and agent for the parliamentary commissioners, there have been employed annually, about 3,200 men upon an average: at first, these men could scarcely work at all; they were totally unacquainted with labour, they could not use the tools, but they have since become excellent labourers; of that number, by the gradual influx and departure of the workmen, we consider that one-fourth left us annually, taught to work; so that these works may be considered in the light of a working academy, from which 800 have annually departed improved workmen. These men have either returned to their native districts, having had the experience of using the most perfect sort of tools and utensils (which alone cannot be considered as less than ten per cent upon any labour,) or they have been usefully disseminated throughout the other parts of the country. Since these roads were opened and made accessible to wheel carriages, wheelwrights and cartwrights have been established in the country, and, in different parts, the plough has been introduced, and other improved tools and utensils are now used.

Was

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Was not the plough used before?—Not in general; in the western and mountainous parts, they frequently used crooked sticks with iron upon them, drawn or pushed along; these improvements have also, of course, led to the inclosure and cultivation of more land. I also conceive that by this mode of employment, the moral habits of the great mass of the working classes are changed. They see that they may depend upon their own exertions for support, and this appears to me to be an object of the first importance; but it goes on silently, and is scarcely perceived, until apparent by the results. I consider these improvements altogether as one of the greatest blessings ever conferred upon any country. They were performed in a very careful manner, Government only paid one half. Whatever public object was proposed, the party was obliged first to make a formal application to the Parliamentary Commissioners, who ordered me, as their engineer, to ascertain, whether it was that useful object represented, and to make an estimate of the expense, and report to them; if they approved, then the estimate was tendered to the party applying, who was asked, "Are you willing to advance and pay into the bank of Scotland one-half of the estimated expense, and give security to pay any further sum required to complete the work, you may then form a committee to superintend and remonstrate to us, but you must have no management, the whole being carried on under the immediate management and direction of the Parliamentary Commissioners," who employed experienced inspectors and sub-inspectors, who constantly and minutely superintended every operation, and previous to the final completion of each contract, a certificate was signed by the parties interested, that the thing was done as intended, paying half the money in the way I have mentioned, and under these regulations the works proceeded satisfactorily and successfully.

What was the sum of public money granted?—About £. 200,000, in the course of 15 years. It has been the means of advancing the country at least a hundred years.

Do you think that the country, from its own resources, would have been wholly inadequate to have effected these improvements?—I believe it would, for many years to come, have done next to nothing; but this offer of half the money from the public was a great inducement, and the land-owners being empowered to borrow money on entailed estates, enabled them to arrange with the bank of Scotland to advance the money as it was wanted. These valuable improvements are now all nearly completed; the last report will be made, I expect, next year.

Do you conceive that the nature of the control exercised by the Parliamentary Commissioners, in the previous consideration of works, examined by scientific persons, and the application of their funds free from local influence, did effect much more extensive benefit than could be expected from any possible application of equal funds in the discretion of private proprietors?—I am satisfied of that being the case.

Do you not consider the manner of forming the commissions, so as to consist in a considerable degree of persons unconnected with the district in which the money was to be laid out, and also the seat of the commission being in London, to have had a salutary and beneficial effect?—I am thoroughly convinced that the purport of this question is of the utmost importance.

Do you think the erection of small and cheap piers in different parts of the coast, would in time contribute greatly to the improvement of the interior of the country, even more than to the improvement of the fisheries?—Yes, much more than the fisheries; that is of far less value than the effect that would be produced upon the country, and its inhabitants.

Do you not think that the wealth and resources of Scotland, and its power to endure taxation, have been considerably increased by the application of these improvements?—I have no doubt about it; I have no doubt it has been greatly so.

Has not the export of the fisheries been great?—Yes, it has amounted to a large sum, but much more substantial improvements have been made in the country itself, by constructing small harbours and piers, with their connecting roads; every part of the interior is opened to the sea-coast, leaving thus the means of export, and also landing places for lime, coal, tar, and other necessary articles. These new roads have annihilated all the ferries; you may now travel from Carlisle to the northern extremity of Scotland without a ferry. By means of these roads and bridges access is opened to and from the interior districts to the several market towns; in short, the advantages are beyond all comparison.

Is it not also a great advantage for the transfer of cattle?—Yes, it is of great advantage for the transfer of cattle; it frequently happened, before the construction of

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of these roads and bridges, that when the cattle came to certain streams they could not pass them, in consequence of the torrents which came from the mountains; and in consequence of these hindrances, and the tracks being so rugged, their feet were much injured before they got to market, and they became poor. Many of these mountains are from two to three thousand feet high, so that the torrents come down with prodigious force; yet these mountains afford good pasturage.

You mean, as the Committee understand, that the fisheries have profited by their works, and that you consider that the improvement of the country has been further advanced?—The country has been improved to a degree which I consider much more important than even the profit which the fisheries have derived.

What breadth for roads do you consider, generally speaking, is necessary in mountainous countries?—From the extensive experience I have had in the Highlands of Scotland, I find that sixteen feet, in general, is quite sufficient for the mountainous part of the country; and through arable lands, and on the coast roads, I find twenty feet to be quite sufficient.

Cannot such roads, where the mountains have gravel bottoms, be constructed at a very small expense?—We find, including ordinary bridges, that the roads vary in expense from £.300 to £.600 a mile. Unless they have to pass over large streams, I think you may take it under £.500 a mile.

Are the roads done in a complete manner?—I believe nothing of the kind need be more perfect, with retaining walls, breast walls, parapets, side and cross drains.

Do you not consider, that not only the most useful lines, but the most economical species of road that can be made, are those which are laid out and executed by scientific and experienced persons?—No doubt of it. On the subject of repairs, under the original system, they were to be done by the counties; after the roads were constructed, they were to do what they liked with them. An act was brought in to enable them to form committees among themselves, to get estimates, and to demand assessments of the counties, necessary to repair the roads in certain districts. That act was in force for five years, and there was not a single committee appointed, nor a single yard of road repaired; after heavy rains, torrents of water were suffered to run upon them, and in fact the roads were disappearing. I avoided making observations for two or three years, but at length I was induced to make representations to the parliamentary commissioners, and to state, that unless some effectual measures were taken, the roads first made would very soon be obliterated. The commissioners then saw that something must be done, and they brought in a bill, and passed it, taking the repair of the roads into their own hands, assessing the counties three-fourths, and Government paying the remainder; but the payment of the inspection by Government and management made it about half. That act was to be in force seven years; it has been so for six years. After this the military roads were also put under the commissioners; this made in the whole about 1,400 miles. These military roads have now been much improved, and the whole kept in good condition, much cheaper than you can expect to do in Ireland; they do not cost £.5 a mile; and those made under the commissioners are in general as smooth as this table. A bill is now before Parliament to determine what is to be done as to future repairs. The Committee will be aware how strictly all those matters must be attended to, not only the making but the keeping up of the roads after they are made. It is in the north of Scotland now arranged quite systematically, that it goes on with perfect regularity; the principal superintendent has twelve or fifteen hundred miles of road under his charge; he annually makes a detailed specification of what is wanted to be done on every part of each road; these specifications are advertised, and contracted to be performed accordingly; he has six sub-inspectors under him; the number is small; in some cases there is not very much travelling, or it would not do; these inspectors are continually on the roads, never a day off them, they have nothing else to do; the general superintendent checks them, and I ascertain that he performs his duty; in that way we keep up a continual strict inspection, to see that what is contracted for is faithfully performed. The contractors are paid by instalments, retaining one-eighth part in hand until the contract is completed, and if any of them is deficient the money is stopped. Thus we are enabled to keep the whole machine going with regularity and proper effect. We pay the inspectors so much for wages, and so much for travelling expenses, when they can prove by their journals that they are on the roads at a distance from him; for every man keeps a journal of his proceedings, also of how many men and horses, &c. are employed upon his district; he must prove he has been upon the road; if it appears that he has not been there, he has no travelling expenses; and those inspectors are connected with no other employment

but

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but the repairs and improvements of these roads; if connected with any thing else, the roads become a secondary object, and are neglected. In this manner road-makers are formed in the same manner as other tradesmen; the great evil has hitherto been, that road-makers have been held too cheap, nothing has been thought so easy as to make roads; whereas, in my experience, there is nothing I find so difficult; formation, materials, drains, walls, bridges, every thing in fact; every particle of matter put on or removed required experience, and you must have men that know and understand all these matters before you have a perfect system of road-making.

You think it would not be possible to repair the roads in Ireland at the price you have mentioned?—In the low countries it would be impossible; in the low countries of Scotland it costs six times that sum; we are now making 100 miles, from Carlisle to Glasgow, but with that exception I never had any of the low country roads under my own management.

Is £.5 the average of all the Highland roads?—Yes, £.5 is the average of the roads in the Highlands, made under the Parliamentary Commissioners.

Does that include the military roads?—No, not the military, I believe they cost about £.10; the military roads were fairly worn out before they came under the Parliamentary Commissioners, and it has required this expense for several years to restore them.

Were they not originally very badly constructed?—Terribly bad; we have them nearly to re-make; they are not perfect yet by any means, but they certainly are very different roads to what they were; but if they had been finished in the way ours were £.5 or £.6 would have done the business of annual repairs.

Do you not conceive, that the roads in the mountainous parts of Ireland might be kept at the same rate?—Yes, no doubt of it; the injury in mountainous countries does not so much arise from the wear of carriages or horses, &c. as from the washing after very heavy storms of rain or snow; in order to obviate that, we have men ready to go immediately to the places where it may be necessary to get the repairs performed, otherwise the road would be destroyed.

Lunæ, 24° die Maij.

Mr. *Robert Fraser*, further Examined by the Committee.

Mr. Robert Fraser.

HAVE you paid much attention to the fisheries, and the best means of their improvement?—I have had many opportunities of acquiring information regarding the fisheries for these thirty years back, at which period my attention was called to this subject, by being appointed extra secretary to the British Society for extending the fisheries, and improving the sea-coast of the kingdom.

Are you acquainted with the Irish fisheries?—I was appointed by the Irish Government, when Lord Hardwicke was Lord Lieutenant, to make an investigation regarding the fisheries on a particular part of the coast, and I have also since endeavoured to obtain information regarding the fisheries on other parts of the coast of Ireland, and the best means of their improvement.

What is your opinion of the abundance of fish on the coast of Ireland?—I have found that on all parts of the coasts of Ireland, where the coast is formed into large bays, which are numerous on the southern and western coasts, that the fishermen never fail to find fish in great plenty; and from the trials I have myself made, and from what I have been informed by the late Captain Huddart, and several naval officers, I am of opinion that there are very valuable fishing grounds at no great distance from the coast, and which ought to be further examined.

In the trials you made yourself, what kind of fish did you find in great abundance?—In the trials off the coasts of Wexford and Waterford, we found cod, ling and haddock; but the fishing on the open grounds was much interrupted by great quantities of dog-fish and sharks; we were therefore most successful in catching the cod fish, particularly on the rocky coasts near the islands of the Saltees, where the shark and dog-fish are not found in such abundance.

What other fish did you meet with besides those you have now mentioned?—Abundance of turbot, johnadoree, plaice, the largest finest soles the fishermen had ever seen, and also skate and halibut in great abundance.

What fishermen do you allude to, and what vessels did you employ in the trials to which you allude?—Two Irish wherries, under the command of Lawrence Mooney, of Irishtown, a very hardy and experienced fisherman, well acquainted with the Nymph Bank, and the whole of the fishing grounds on the south of Ireland; we began making the trials on the Nymph Bank, on the 30th of May 1802, and continued

Mr. Robert Fraser. (24 May.)

tinued until the end of August; but the weather was very much broken that season, and the regular trials much interrupted, but perfectly satisfactory as to the abundance of fish.

Do you consider the Irish wherries well adapted for carrying on the fishery?—The wherries are excellent sea-boats; they fish with long lines, and are well calculated for shooting and hauling the lines, under the easy management of the foresail. They are furnished with nets for trawling, in order to catch ground fish, viz. turbot, plaice, soles, &c. They are provided also with nets for catching herrings.

Are you of opinion, the fisheries of Ireland might be carried on more extensively? Ireland is better calculated for carrying on the fisheries in an extensive manner than any part of the United Kingdom, or perhaps than any country in Europe. For independent of the fertility of the ocean with which Ireland is immediately surrounded, the navigation to the coasts of Scotland, where herrings always abound in greater or lesser quantities, and the navigation to the north of the Shetland Isles, where the Dutch fish for herrings, is speedy, safe and certain. Besides also the excellent situation of Ireland for carrying on the cod fishery on the coast of Iceland, and on the banks of Newfoundland. As a further advantage, the Irish have a near and most extensive market, from its proximity to the most populous counties in England, where the people being much employed in manufactures, do not pursue the fisheries to any considerable extent. Above all, Dunmore, in the county of Waterford, is admirably situated for carrying on the fisheries of every description.

To what cause do you attribute that the Irish fisheries are not carried on to the extent of which you deem them capable?—The immediate cause of the decline of the boat fishery, is solely to be attributed to the heavy duties on the importation of rock-salt, which took place about twenty years ago, on account of which the numerous refineries of salt which supplied the country with salt at a very low price were given up. In the year 1796 I made a tour through the baronies of Forth and Bargie, in the county of Wexford, where I found every little farmer had a cask of salted fish, consisting of cod, hake, and ling, and also salted herrings, being supplied from the refineries at Wexford at a moderate price. Red herrings were cured at Wexford, and sent to England and Dublin, and a considerable boat fishery was carried on. When I was collecting materials for my statistical survey of that country, in 1803-4, the salt works were wholly abandoned. The curing of red herrings was given up, and I did not find any of the little farmers able to procure a single barrel of salted fish for their winter store. I am therefore decidedly of opinion, that it will be a very difficult task to revive and extend the boat fishery, without the duty on rock salt is repealed; but until that measure takes place, the fisheries on the coasts would be greatly encouraged by having depots of rock salt formed on various parts of the coast; rock salt crushed, given duty-free to the boatmen, under certain regulations and restrictions, which might be easily complied with.

What would you propose as the best means of encouraging the fisheries and improving the sea-coasts of Ireland?—That a bill should be introduced into Parliament, for the encouragement of landed proprietors to build towns, villages and fishing stations in Ireland, and for enabling the proprietors of land in Ireland to charge their lands with a proportion of the expense in making and maintaining harbours, roads and bridges; on a principle similar to the Acts of Parliament passed for similar purposes in Scotland.

APPENDIX:

VIZ:

THE FOUR REPORTS OF THE COMMISSIONERS

(1810—1814)

Appointed to inquire into the Nature and Extent of the several Bogs in *Ireland*, and the practicability of draining and cultivating them:

WITH

EXTRACTS FROM THE SEVERAL APPENDIXES TO THE SAME,

Containing the principal Matters of general interest therein:

WITH EIGHT PLATES.

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APPENDIX.

—(1.)—

THE FIRST REPORT of the Commissioners appointed to inquire into the nature and extent of the several BOGS in *Ireland*, and the practicability of draining and cultivating them.—(10 June 1810.)

THE Warrant under which we are appointed Commissioners, having been issued on the 15th day of September 1809, we assembled in Dublin on the 19th day of the same month; and after having taken the Oath prescribed, proceeded to form a plan for the execution of the Trusts reposed in us by the Legislature.

We consider it a fortunate occurrence that shortly previous to our appointment Mr. *Rennie* had been in Dublin, and although his engagements in England precluded us from having an opportunity of formally consulting him at our Board, yet we found that two of the Commissioners had had the fullest communication with him on the subject of our Commission, and conceived themselves to be in full possession of his ideas on the subject.

After committing to paper the outline of such instructions as appeared to us to be necessary for the guidance of our Engineers, and conformable to Mr. *Rennie's* ideas, we consulted different engineers and surveyors as to the practical execution of it in detail, and finally reduced the whole into the form of "the Instructions," which form the 1st Article of the Appendix to this Report.

[*It has not been thought necessary to reprint the Appendixes.*]

The execution of our commission demanding considerable accommodation and space for the Maps, Sections, and Instruments necessary for the investigation of the subject committed to us, it became an object to obtain the permission of the Dublin Society to hold our meetings in their house; and they (with the liberality which ever distinguishes them when the improvement of Ireland is the object) immediately acceded to our request.

On our part, with a view to economy, we appointed their Assistant Secretary the Secretary of our Commission, and the Superintendent of their Repository his Assistant Clerk: to the former we gave a salary of £. 200 per annum, to the latter one of 50 guineas, and these two sums, amounting in the whole to £. 256. 17*s*. 6*d*. form the entire annual expense of our establishment.

Division of the Bogs into districts.

Our next object (and on the due attainment of which depended in a great degree the success of our undertaking) was the proper division of the Bogs of Ireland into the Districts referred to in the 1st Article of the Instructions; and further, to determine in what part we should first apply those means intrusted to us, and which we at once perceived were utterly inadequate to the execution of any Plan that should embrace the entire extent of Ireland.

In forming our opinions on these points, we derived our principal assistance from the Great Ordnance Survey of Ireland, executed by General Vallancey, the Chairman of our Board, it being the only Map which defines either the situation or boundaries of the Bogs with any tolerable accuracy.

From inspection of this Map we are enabled to consider the greater part of these Bogs as forming one connected whole, and to come to the general conclusion, that a portion of Ireland, of little more than one fourth of its entire superficial extent, and included between a line drawn from Wicklow head to Galway, and another drawn from Howth head to Sligo, comprises within it about six-sevenths of the Bogs in the island, exclusive of mere Mountain Bogs, and Bogs of less extent than 500 acres, in its form resembling a broad belt drawn across the centre of Ireland, with its narrowest end nearest to the Capital, and gradually extending in breadth as it approaches to the Western Ocean. This great division of the island extending from east to west is traversed by the Shannon from north to south, and is thus divided into two parts; of these the division to the westward of the river contains more than double the extent of the Bogs which are to be found in the division to the eastward; so that if we suppose the whole of the Bogs of Ireland (exclusive of mere Mountain Bog and of Bogs under 500 acres) to be divided into twenty parts, we shall find about seventeen of them comprised within the great division we have now described, twelve to the westward, and five to the eastward of the Shannon, and of the remaining three parts, about two are to the south and one to the north of this division; of the positive amount of their contents we have as yet no data that can enable us to speak with any precision, but we are led to believe, from various communications with our engineers, that the Bogs in the eastern division of the Great District above described, amount to about 260,000 English acres, which on the proportion already mentioned would give rather more than one million of English acres, as the total contents of the Bogs of Ireland, excluding however from consideration mere Mountain Bogs, and also all Bogs of less extent than 500 acres, of each of which description the amount is very considerable: of the extent of the latter some idea may be formed from a fact which we have learned from Mr. Larkin, that in the single county of Cavan which he has surveyed, there are above ninety Bogs, no one of which exceeds 500 Irish acres, but which taken collectively contain about 11,000 Irish, which is equivalent to about 17,600 English acres, besides many smaller Bogs varying in size from five to twenty acres.

Bogs eastward of the Shannon.

Most of the Bogs which lie to the eastward of the Shannon, and which occupy a considerable portion of the King's county and county of Kildare, are generally known by the name of the Bog of Allen; it must not however be supposed that this name is applied to any one great morass; on the contrary, the Bogs to which it is applied are perfectly distinct from each other, often separated by high ridges of dry country, and inclining towards different rivers, as their natural directions for drainage, so intersected by dry and cultivated land, that it may be affirmed generally there is no spot of these Bogs (to the eastward of the Shannon) so much as two Irish miles distant from the opland and cultivated districts.

Eastern portion of the Great District.

With this first and general view of the subject, we had no hesitation in selecting at once the whole of the eastern portion of the Great District above referred to, as the object of our first inquiries, forming in itself one whole, whose parts had more or less connexion with each other, lying in the centre of Ireland, in the immediate vicinity of some of the richest and best cultivated counties; intersected also by the two great lines of navigation, the Grand, and the Royal Canals, and presenting in common apprehension very considerable obstacles to improvement; the overcoming of which would in itself demonstrate the practicability of the improvement of the Bogs of Ireland in most other cases.

We were further induced to form this selection on the general principles of beginning at the end of the great division above referred to, which lies nearest to the Capital, and proceeding gradually to its termination at the Western Ocean; not however considering ourselves precluded from making occasional exceptions, where particular circumstances might appear to require it.

The proportion which the Bogs in this District bear to the entire of the Bogs of Ireland, appeared to us a farther inducement; and we are the more disposed to mention this, as we find that by some we have been thought to have embarked in the first instance on too great a scale: on this we shall merely observe, that having two years allotted to us for the duration of our commission, we undertook at once rather less than one-third of our task, in the supposition that it would require about eight months for its execution.

Having determined to give in charge the whole of this District, it became the next object of our consideration on what principle we should subdivide it into the smaller Districts referred to in the First Article of our Instructions, for the purpose of being assigned to separate engineers; Major Taylor's excellent Map of the county of Kildare furnished us with every necessary information, so far as that county was in question; but of the King's county there was no Map published, and as it contains not less than 124,000 English acres of Bog, it became a most important object to possess ourselves of the necessary information with respect to them.

We therefore thought ourselves fortunate in finding that Mr. Larkin, a surveyor of eminence, had surveyed the county for the Grand Jury; and we contracted with him to furnish us with a Map of it, on the large scale required by our Instructions; and Mr. Larkin making himself responsible for the accuracy of the survey, we agreed to give him for it £.300, being at the rate of less than three farthings per acre for every acre of Bog it contained. With these and the assistance of other documents, we divided all the Bogs containing above 500 acres, in the counties of Kildare, King's county, Tipperary, Westmeath, and Longford, into seven districts. Of these we gave the one which forms the north-eastern part of the Bog of Allen, in charge to Mr. Richard Griffith; the south-eastern to Mr. Brassington; the north-western to Mr. Townshend; the south-western to Mr. Longfield; a district lying principally in Westmeath, to Mr. Jones; and the Bogs in the county of Longford and on both banks of the river Inny, to Mr. Edgeworth.

Division of Bogs into 7 districts;
Mr. Richard Griffith.
Mr. Brassington.
Mr. Townshend.
Mr. Longfield.
Mr. Jones.
Mr. Edgeworth.
Mr. Aher.

We also gave a large district of Bog in the county of Tipperary, which runs nearly parallel to the Suir from Roscren to Cashell, in charge to Mr. Aher, wishing to take advantage of the circumstance of his being able to give a portion of his time to that district, although not to any other, on account of his other engagements.

We next laid down the principles which were to govern our expenditure, in such manner as to secure that the amount of our disbursements should depend in every instance on the degree of labour to be performed.

Engineers, &c.

With these views, we fixed the pay of Engineers at two guineas a day for every day actually employed, and one guinea a day in lieu of allowances for travelling and board and lodging. That of their Surveyors at one guinea a day for each, while employed, to be at once their pay and in lieu of all allowances of every description. For the Staff-men, Chain-men, and Labourers, we intrusted the Engineers to make the best bargains in their power, not exceeding three shillings per day in any instance; and these terms we trust will appear extremely moderate when compared with those usual in Great Britain, and considering the hardships attendant on this peculiar service. The appointment of the Engineers

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gineers we necessarily hold in our hands, and select them under the obligation of our oaths; the appointment of the Surveyors we commit entirely to the Engineers, holding the latter responsible for the qualifications of the persons they employ.

We account with every Engineer once a week, and he makes his return to us upon his oath.

To give an idea of the scale and nature of our Expenditure, we subjoin as the 2d and 3d Articles of our Appendix, Copies of Accounts already called for by your Honourable House*.

Owing to the winter season having set in, almost immediately after the appointment of the Engineers, and which was particularly unfavourable to the execution of the survey, we have as yet received but one of their Reports, although they are most of them, we believe, in a state of considerable forwardness.

See Extract (5) & (6) infra.

This Report we have determined on laying at once before your Honourable House, considering it as sufficient in itself, to enable the Public to form a pretty accurate opinion of the degree of information which may be expected from the execution of our Commission; and feeling also, that if we deferred it any longer, we should have no other opportunity before the opening of the next Session; we have accordingly subjoined it as the fourth Article of the Appendix to this Report.

The district reported on, contains 36,430 English acres of Bog, and forms the eastern extremity of the Bog of Allen. The Map furnished to us by Mr. Griffith is on a scale of four inches to an Irish mile, and is accompanied by Sections of the Bog of nearly 200 miles in extent.

As these Maps and Sections could not be engraved without enormous expense, we have subjoined to this Report a Map executed on a scale as much reduced as is consistent with clearness, and which scale we propose to apply universally in the different Maps which in the execution of the Commission it will become our duty to furnish to your Honourable House; and this Map we have accompanied with three lines of Sections of the Bog, to serve at once as specimens of the manner in which the Sections are executed, and to convey a clearer view than could be expressed in words, of the internal structure of a great Bog; a view we believe materially different from any of those generally received.

Nature and structure of Bogs.

There are many, we believe, who consider the Bogs of Ireland to be low and marshy tracts of country, not very dissimilar in their composition from the fens of Lincolnshire; others, aware that the substance of which they are formed, greatly differs from that of the fen districts, attribute nevertheless the origin of both to pretty nearly the same causes; while an opinion, more prevalent, and perhaps not less erroneous than either of the foregoing, attributes their formation to fallen forests, which are supposed at some former period to have covered these districts, and to have been destroyed either by the effects of time, or by hostile armies in the early wars of Ireland.

The facts stated in Mr. Griffith's Report are obviously inconsistent with any of these suppositions; the Bogs which he has surveyed being every where in elevated situations, and the trees which have hitherto been so constantly found buried in the edges of these Bogs, where alone it is probable they have generally been sought for, are very rarely to be found, in the interior parts at least of this district.

Without entering in this Report into any inquiry as to the origin of Peat Bogs, we are however anxious to give to such persons as have not had an opportunity of examining them, some idea of the general appearances which they actually present.

It appears from Mr. Griffith, that each of the four Bogs included in the subject of his Report, is a mass of the peculiar substance called Peat, of the average thickness of twenty-five feet, no where less than twelve, nor found to exceed forty-two; this substance varying materially in its appearances and properties, in proportion to the depth at which it lies: on the upper surface, covered with moss of various species, and to the depth of about ten feet, composed of a mass of the fibres of similar vegetables in different stages of decomposition proportioned to their depth from the surface, generally however too open in their texture to be applied to the purposes of fuel; below this generally lies a light blackish brown turf, containing the fibres of moss still visible, though not perfect, and extending to a further depth of perhaps ten feet under this. In the instance exhibited in the Section at the close of Mr. Griffith's Report, are found small branches and twigs of Alder and Birch, but we do not understand him as being of opinion that such is by any means generally the case; at a greater depth the fibres of vegetable matter cease to be visible, the colour of the turf becomes blacker, and the substance much more compact, its properties as fuel more valuable, and gradually encreasing in the degree of blackness and compactness proportionate to its depth; near the bottom of the Bog it forms a black mass, which when dry has a strong resemblance to pitch or bituminous coal, and having a conchoidal fracture in every direction, with a black shining lustre, and susceptible of receiving a considerable polish.

We have requested Mr. Griffith to make a chemical analysis of these different strata, which he has done in the Laboratory of the Dublin Society, and an account of which, with the Section above alluded to, forms the Appendix to his Report. Immediately below this lower stratum, there is generally found a thin stratum of yellow or blue clay, varying in thickness from one to six feet; in some places the Peat rests on a thinner stratum of yellowish white marl, containing on an average about sixty per cent. of calcarious matter: this

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* It has not been thought necessary to reprint the Appendixes.

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stratum of clay in this district universally rests on a solid mass of clay and limestone gravel mixed together, and extending to an unknown depth.

We should further consider the Peat moss as partaking in its general nature of the property of sponge, completely saturated with water, and giving rise to different streams and rivers for the discharge of the surplus waters which it receives from rain or snow; these streams in this district almost universally have worn their channels through the substance of the Bog down to the clay or limestone gravel underneath, dividing the Bog into distinct masses, and presenting in themselves the most proper situations for the main drains, and which, with the assistance of art, may be rendered effectual for that purpose.

Such is the internal structure of the Bogs in this district.

Viewing them externally, they present surfaces by no means level, but with planes of inclination amply sufficient for their drainage; the highest summit of any part of the Bogs in this district, is 298 feet above the level of the sea, taken at an ordinary spring-tide in the Bay of Dublin; while the lowest point any where on their surface, is eighty-four feet lower than the highest, and therefore 214 feet above the level of the sea.

It requires a mere inspection of the Map and Sections, to be convinced that there is no part of these Bogs from which the water may not be discharged into rivers in their immediate vicinity, and with falls adequate to their drainage; and we observe that in the instance of the Bog of Timahoe, a part of its water is discharged into the sea at Drogheda, and another part below Waterford.

Expense.

IT is now our duty to report on the probable expense of the proposed operations; and if we are conscious of the general fallacy of estimates, we must be so peculiarly in the case of works such as those which form the subject of our Report.

We have therefore required the estimates to be given in to us, in their most minute details, and we have the satisfaction to observe, that the data on which Mr. Griffith's estimate is formed, are taken from the expense of works executed by the Grand Canal Company in these very Bogs.

This Company has had abundant experience of the extent of the expense of every variety of drains, excavations, and embankments necessary for draining the Bog preparatory to the carrying their Canal through it; and we know Mr. Griffith to have had access to their accounts, and that it is with the full knowledge of them, as well as of other sources of information, that he has made his calculations.

It is Mr. Griffith's opinion, that by the main drains laid down in the situations referred to in the Map, and with a system of minor drains discharging their waters into the main drains, and at a general distance of a quarter of an Irish mile from each other; and further, with a system of cross drains discharging themselves into the minor drains, and at a distance of 280 yards apart, the entire Bog may be rendered sufficiently compact for the commencement of agricultural operations. The cost of the different improvements proposed in the rivers, and of the main and minor drains, he estimates at - - - - - £. 49,268
And of the cross drains, at - - - - - - - - - 20,746

Altogether - - - - £. 70,014 as being the expenses of discharging the waters from these 22,490 Irish acres, equivalent to 36,480 English acres of Bog, sufficiently to enable the farmer to commence his operations on them. In this view of expense it is however particularly worthy of consideration, that there is a further extent of no less than 4,000 Irish acres, not of Bog, but of good land lying along the banks of the river, whose course it is proposed to improve, and the expense of improving which is included in the £. 70,014. These 4,000 Irish acres appear to be at present covered with water for not less than half the year, and to set at an average rent of less than thirty shillings per acre, while the uplands in the immediate vicinity set for not less than three guineas.

In the opinion of Mr. Griffith, these low lands, if preserved from these inundations, would become more valuable than the uplands; supposing them however to receive an increase of only twenty shillings per acre in their annual value, and estimating this increase at twenty years purchase, an improvement would be effected to the value of £. 80,000, which is more than sufficient to cover the entire expense of the proposed drainage, not merely of these inundated lands, but of the Bogs also; so that if the operation were to be carried into effect, and considered in a general view, it would appear that the profit of recovering these 4,000 acres of inundated lands, would be more than equivalent to defray the entire cost both of their own reclamation, and of the drainage of all the Bog in this district; whatever therefore might be the increase of improvement, which the entire extent of Bog might receive from the drainage, would be every part of it so much clear gain resulting from the adoption of the operations suggested by Mr. Griffith. The dimensions recommended by Mr. Griffith for the main drains, are a breadth of fourteen feet at top, of two feet at bottom, and a depth of twelve feet; for the minor drains, a breadth of nine feet at top, one foot at bottom, and a depth of eight feet; and for the cross drains, a breadth of six feet at top, one foot at bottom, and a depth of five feet.

Adverting to an opinion which some may entertain, that the breadth recommended for the bottom of these drains is not sufficient, Mr. Griffith observes, that it has been found by experience in the Bogs passed through by the Grand Canal, where there was any fall, deep drains with narrow bottoms were kept clear at bottom by the running water, but that the contrary

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contrary was the case where their bottoms were made broad; as the same quantity of water, being thinly spread on the bottom in the latter instance, was not sufficient to carry off the particles of Peat which it contained, but deposited them on the bottom of the drain, which on this account required frequent scouring.

The mode in which Mr. Griffith proposes to construct these drains, so as to obviate as much as possible the tendency of the sides to collapse, deserves particular attention, not merely on account of the simplicity and ingenuity of the principle, but as possessing the recommendation of having answered on the trial, which it has received in the different works undertaken in these Bogs by the Grand Canal Company.

We beg to be understood as by no means pledging ourselves to an opinion, that in all cases such drains, and in the same proportion, would be sufficient to discharge the waters of a great Bog; it is a point on which we wish to reserve the expression of our own opinion, until we shall have had an opportunity of comparing the opinions of our other Engineers. We consider the inquiry referred to us as divisible into two general heads, namely, the practicability of draining the Bogs of Ireland, and secondly, of cultivating them when once drained. In a subsequent Report we shall feel it our duty to enter fully into the latter consideration, hitherto our views have been more directed to the former; since if the drainage should appear to be either impracticable, or attainable only at an expense disproportionate to the object, the latter inquiry would become of little moment; at present we shall merely observe, that we believe there is hardly a part of Ireland in which the evidence of facts does not furnish the most complete refutation of the opinion, "that a drained Bog is not susceptible of the excitement of manure."

On this Mr. Griffith observes to us: "In answer to an assertion made by some persons, " that a Bog deprived of water is a Caput Mortuum, on which no plant will vegetate, either " spontaneously or by any alteration in the composition of its surface that can be effected; " it may be observed, that although Bog when first drained appears to have lost the power " of supporting aquatic plants, without a capability of supplying food for the vegetation of " plants of a different or more useful nature, still if we have patience till the *Bog Moss, &c. " which composes the upper surface of the Bog, shall have subsided, and by the near ap" proach of their mossy fibres (which when alive are kept asunder by water) and exposure to " the atmosphere, shall become (to a certain degree) putrid, it will be found that various " grasses of good quality, and even white clover, will vegetate spontaneously on its " surface."

"But it is not to be supposed that an active people will thus suffer Nature, unassisted, " slowly to attain a desirable alteration in the upper surface of draining Bogs; they will " naturally join hand in hand with her; and by the simple process of digging or ploughing " up the surface of the drained Bog, and by gathering it into heaps and (in dry weather) " setting fire to them (having previously mixed a portion of clay amongst the heaps, which " is always to be found in inexhaustible quantities beneath the Bog) accomplish in two " years, what Nature, unassisted, might have attained (less perfectly) in ten."

A prejudice much more extensive than that of the irreclaimability of a drained Bog, is, an apprehension which we have found very generally entertained, that in the event of the success of these operations, the country would be left without a sufficient supply of fuel. It seems not to be generally understood, that if the Bogs of Ireland could be reclaimed, we should derive not merely the advantage of cultivating their surface, but at the same time, that the power of applying them wherever necessary for fuel, would be increased some hundred or rather some thousand fold. Fuel can at present be obtained only from the edges of these Bogs; the excessive wetness of their interior rendering it in its present state wholly unavailable for fuel, but if once drained, fuel might be procured from every part of them; and it is a great mistake to suppose that the drainage of a Bog would impair its qualities as turf, on the contrary, it would operate as the greatest possible improvement of it, and that not merely at the time when it was effected, but at all future periods, and in a degree progressively increasing.

And we are further convinced, that those who apprehend a scarcity of turf fuel, have formed a most erroneous comparison between any possible demand and the certain power of supplying it. It appears by Mr. Griffith's Report, that the entire proportion of Bog in this district already exhausted by the supply of fuel, amounts to no more than 1,117 English acres, that is, less than one thirty-second part of its whole extent.

And further, if these Bogs ever should be reclaimed, if it should indeed become more desirable to use them for fuel than for cultivation, we may be certain that the profit inseparable from that circumstance, would insure that such would be the application; it may reasonably be supposed that the effect would be, that so small a proportion as might be necessary for fuel, would continue to be applied to that end, and that the remainder would be no less profitably employed for the purpose of agriculture.

It was our wish to have stated the rate of expense per acre at which the survey is conducted under our direction, a point, however, which we find it impossible to ascertain, until we

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* "Sphagnum Palustre.—The pulp of the Bog, as has been already observed, is composed of va" rieties of this Moss.—To exemplify as far as possible the various stages of decomposition which the " Moss has undergone between the top and bottom of a deep Bog, I have added at the end of this Re" port a Section, with a description and analysis of every variation in the colour and composition of the " Moss, from the top to the bottom of a Bog of 38 ½ feet in depth."

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FIRST REPORT ON THE BOGS OF IRELAND;
(June 1810.)

we shall have received Reports from our different engineers. Most of the surveys of the districts between Dublin and the Shannon, are already far advanced towards completion; and we expect at the commencement of the next Session, to be enabled to report to your Honourable House, upon the whole of the eastern portion of the great division of Ireland included between the lines mentioned in the first part of our Report, accompanied with a skeleton Map, showing the connexion of these districts. In proportion as they shall be completed, we shall send forward the engineers who have been employed in them to districts more remote, and proceed, as fast as the means which may be intrusted to us will permit, in completing the survey of the remaining Bogs of Ireland.

CH. VALLANCEY, (L.S.)
RICHARD GRIFFITH, (L.S.)
HENRY HAMILTON, (L.S.)
J. LESLIE FOSTER, (L.S.)
WILLIAM GORE, (L.S.)

Dated this 10th day of June 1810.

—(2.)—

SECOND REPORT ON THE BOGS OF IRELAND.

(8 March 1811.)

IN our First Report we submitted to your Honourable House our general view of the extent and nature of the Bogs of Ireland, accompanied by a detailed Report from one of our Engineers, upon a portion of the Bog of Allen, containing 36,430 English acres; we now proceed to lay before your Honourable House the following Reports, which we have since received from our Engineers.

	Containing of Bog Engh Acres.
1st. From Mr. Richard Griffith, junior, on the Western Division * of District No. I. or the District of the River Barrow - -	41,075
2d. From Mr. Jones, on District No. IV. or the District of the River Boyne - - - - - - - - - -	42,370
3d. From Mr. Longfield, on District No. V. or the District of the River Brusna - - - - - - - - -	44,594
4th. From Mr. Townshend on District No. VI. or the District of the Shannon - - - - - - - - - -	34,500
5th. From Mr. Edgeworth, on District No. VII. or the District of the Inny and Lough Ree - - - - - - -	34,569
Total English acres comprised in this Report - -	197,108
Which, together with the Bogs included in our First Report,	36,430
Make in the whole - - English acres	233,538

In our First Report we were enabled to come to this general conclusion, that about 6-7ths of the Bogs of Ireland are contained within a portion of the Island of little more than one-fourth of its entire superficial extent, included between a line drawn from Wicklow head to Galway, and another drawn from Howth head to Sligo; in its form resembling a broad belt drawn across the centre of the Island, with its narrowest end nearest to the Capital, and gradually extending in breadth as it approaches to the Western Ocean. This great division of the Island extending from east to west, is traversed by the Shannon from north to south, and is thus divided into two parts; of these the division to the westward of the river contains more than double the extent of the Bogs which are to be found in the division to the eastward; our present and our former Report taken together, include all the Bogs which lie in this division to the eastward of the Shannon, except a small detached district of 4 or 5,000 acres in the county of Kildare, which we gave in charge to Mr. Brassington, and whose Report we did not receive in time to include in this statement. These Bogs forming the subject of our First and of our present Report, and including not only the whole of what is usually denominated the Bog of Allen, but also the Bogs in the counties of Longford and Westmeath, may be considered generally as divided into *five* great Districts very distinct from each other. The first, comprising 77,505 English acres of Bog, has its natural falls for the ventage of its waters to the river Barrow.

	Feet.
The greatest height of the surface of the Bogs in this District above the sea at high water mark in Dublin Bay, is - - - - - -	315.
Their least height - - - - - - - - - - -	189.
Their greatest depth - - - - - - - - - -	41.
Their average depth - - - - - - - - - -	22. to 25.

This District forms the subject of Mr. Richard Griffith, junior's, 1st and 2d Reports.

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* For his Report on the Eastern Division of this District, see the Appendix to the First Report of the Commissioners.

The next of these Districts (No. IV. reported on by Mr. Jones) may properly be denominated the District of the Boyne, as almost all the waters of its Bogs are discharged into the sea through that river.

	Feet.
The greatest height of the surface of the Bogs in this District above the sea at high water mark in Dublin Bay, is	336.
The least height (as we collect from Mr. Jones's table)	218.
Their greatest depth	40.
Their average depth	22. to 25.

The third and fourth of these Districts are separated from those already mentioned by a high and broad tract of comparatively dry country, which stretches north and south of Tullamore; these two Districts have their natural falls to the river Shannon, and are divided from each other by the river Brusna; of these the District to the northward of the Brusna contains 34,500 English acres of Bog, and forms the subject of the Report of Mr. Townshend.

The District to the southward of the Brusna contains 44,594 English acres, and is reported on by Mr. Longfield.—Of the Bogs in Mr. Townshend's District,

	Feet.
The greatest height of the surface above the sea at high water mark in Dublin Bay, is	274.
Their least height	114.
Their greatest depth	44.
Their average depth	30.

And in Mr. Longfield's District,

Their greatest height above the sea	310.
Their least height	111.
Their greatest depth	45.
Their average depth	22. to 25.

The fifth of these Districts, reported on by Mr. Edgeworth, contains two tracts of Bog, amounting in the whole to 34,611 English acres. Of these the first lies on the banks of the river Shannon, and depends on it for its drainage; the latter discharges its waters into the river Inny, which also flows into the Shannon. The Bogs in this District are deeper than any others we have observed.

	Feet.	In.
The greatest height of their surface above the sea at high water mark in Dublin Bay, being	253.	8.
Their least height	176.	8.
Their greatest depth	47.	0.
Their average depth	30. to 35.	

Thus it appears that these Bogs (presenting in every instance sufficient falls for their drainage) discharge their waters into the sea, in widely different directions; those from Mr. Richard Griffiths, junior, and Mr. Jones's districts, flowing into the Irish Channel; the former by the Barrow at Waterford, the latter by the Boyne at Drogheda: while the waters of the Bogs in Mr. Longfield's, Mr. Townshend's, and Mr. Edgeworth's Districts, are ultimately carried by the Shannon into the Atlantic Ocean.

We propose to accompany our next Report with an Index Map, exhibiting the connection of these and other Districts.

In comparing the Reports of our Engineers with each other, we find, as might be expected, considerable difference of opinion as to the most eligible modes both of draining these Bogs, and of reducing them to a state of cultivation. They all however agree, not merely as to the perfect practicability in every instance of reclaiming them, but also that the measure would be attended with a very great degree of profit; and we are far from being disposed to believe, when they propose different means for arriving at the same end, that one only can be right.

We shall now endeavour to present the result of their opinions to your Honourable House, and for greater clearness, shall class them under the different heads:

1st. Of Drainage.	3d. Of Planting.
2d. Of Agriculture.	4th. Of Estimates and Expense.

On the Drainage of Bogs.

In the several Districts which have been reported on, the Bogs are intersected by streams, the channels of which are generally in the under strata, usually consisting of gravel or clay, and thus suited to become the principal outlets for the waters taken off the interior of the Bogs; and on the surfaces of the Bogs there appear to be abundant falls towards these streams, to carry into them the surface water, by the means of such drains as the Engineer may judge to be expedient.

It will not be necessary to deepen or alter the course of any great River for the purpose of carrying off the water drained from these extensive tracts; some alterations, however, are proposed by the Engineers, to be effected in the lesser streams, the expense of which will be covered by the improvement of the adjacent flooded lands. We state this, because it has been erroneously conceived, that if any considerable proportion of the Bogs of Ireland were to be drained, it would be necessary to execute expensive works in deepening or altering the channels of some of the principal Rivers.

We feel it necessary to enter into some detail on the different modes of Drainage which have been proposed to us, on account of the differences of opinion which we have already stated to exist among our Engineers; and also, because it is a general topic of inquiry, whether deep or surface drainage is best adapted to the reclamation of Bog; on which some have even gone so far as to doubt the practicability of draining Bog at all, without sinking to the under strata.

This is a point of great importance, because it must be evident that to sink drains to the bottom of Bogs, so deep as those reported on, would occasion such an expense as the subsequent improvement of the land would hardly cover; and the expediency of the project of draining the Bogs of Ireland, if it rested on this point, might be doubtful.

But we have the most satisfactory proof, in the Reports of our Engineers, that such deep drainage is not necessary, and that the surface of a Bog may be highly improved, so as to bear crops, without drawing off the water from the lower strata.

Mr. Longfield states, that the vegetable matter of which the Bogs in his District are composed, is *perfectly* retentive of water, so much so, that the numerous duck-pools and lodgments of water in Bogs are almost all upon different levels; and that in the 10th division of his District, there exist two considerable bodies of water at the distance of a few perches only from each other, and yet differing two feet and an half in the levels of their surfaces.

Mr. Edgeworth remarks, that in Bogs No. 1. and 9. in his district, some drains, six or seven feet wide and as many deep, had been made from the centre of the Bog to its outlet; these were about 20 perches asunder, and although they had been finished for 20 years and were not choaked up, the Bog between them did not appear to have been affected by them. He also states, that deep drains do not carry off the water from any considerable extent of the adjoining surface.

On this part of the inquiry, Mr. Richard Griffith junior's observations appear to us to be worthy of great attention. "The practicability of draining very wet Bogs, he says, has been "doubted by many sensible men, from the fact (which is undeniable) that 10 or 15 yards "towards the interior, from the face of a turf bank, the surface of the Bog is frequently found "extremely wet, and therefore (it is said) if the surface of a Bog near the edge of a turf "bank (from whence there is always a fall of at least 10 or 12 feet) be not drained, it cannot "be expected that any system of drains will ever accomplish that end." But in answer to this he observes, "That the surface of all Bogs near the edges is much lower than the interior, where the springs are usually situated which chiefly supply the water contained in the "Bog; the water from these sources naturally flows towards the exterior, which is on a lower "level. How can it be expected that turf banks formed at the edges of Bogs so situated, "will prevent the flow of the water from the interior? Owing to the side cuts usually made, "will they not have a tendency to draw more water to those points than would have naturally flowed there? But if the drains proposed in his Report (he observes) were cut in "any Bog, the water from the interior would be *arrested in its progress towards the edge*, "and quickly discharged by the minor and cross drains. The natural consequence of "the adoption of such a system, in his opinion, must be nearly perfect superficial consolidation."

In these observations, Mr. Richard Griffith junior appears to us to have well answered the objection, as far as it rests on the observed effects of turf banks; and with respect to the other difficulties, we may remark, that lakes in Bogs, such as Mr. Longfield notices, are situated in hollows; that the Bog stuff forming their banks is always, with respect to the rest, in a state of comparative solidity, whether rendered so by distinct causes previous to the formation of the pools (which seems very probable) or by the decomposing effects of a body of water gradually reducing it to puddle, in which state it is afterwards dried and hardened in summer. The drains mentioned by Mr. Edgeworth, were probably insufficient in size or number to carry off the water of the Bog, which was retained in every part of it by the capillary attraction of its fibrous texture.

Mr. Townshend's observations throw further light upon the subject; he informs us, that strata of turf of a firm and close texture, impervious to water, exist in every Bog; and he is decidedly of opinion, that the springs under the Bog do not penetrate upwards through this substance, but that the wetness of the Bog is caused by the rain water falling on the surface and lodging in the small cracks and fissures, and in the spongy texture of the surface moss and other vegetation, which varies in depth according to its nature and quality; these strata retain the rain-water until it is exhaled by the atmosphere, or is slowly drained by the natural descent of the surface.

But we do not feel it necessary to adduce many arguments or further observations on this question, as we have the evidence of some thousands of acres of Bog in different parts of these districts, which have been thoroughly drained and profitably improved; a circumstance that would never have taken place, if the very nature of the substance, and not more probably some local cause, opposed such difficulty to the undertaking.

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We shall now give an abstract of the system of Drainage recommended by our several Engineers, so as to bring together, at one view, the information we have obtained, as far as the limits of a Report will admit.

Mr. Longfield, arguing upon the retentive nature of Bog, considers that the efficacy of drains is not proportioned to their depth beyond a certain extent; his system is therefore one of main, minor, and cross drains of moderate dimensions; which he recommends on consideration as well of the nature of the undrained Bogs in his district, as of the mode of drainage adopted in parts already reclaimed. The main drains he proposes to be from 10 to 15 feet in depth, the surface drains to be 4 feet in depth and 4 feet in breadth, with perpendicular sides. This form of drain Mr. Longfield is induced to recommend, from his having found that such drains stand remarkably well, even where they have been 7 feet deep and 4 feet wide (as may be seen now in the *Red Bog of Lettybrook*) and are easily passed over, and not liable to be choaked by accidental crumbling of the banks. To the objection, that the sides of perpendicular drains in soft Bogs would collapse or close together, he answers, that experience proves the contrary; that perpendicular sides do not retain or catch the waters falling on the surface, but harden, and become in fact "a Bog wall," supported and kept together by its unbroken fibres from top to bottom; whereas the sides of sloped drains being exposed to the weather, are kept nearly in their original state of wetness. This form, however, Mr. Lougford does not recommend for the principal or main drains, the talus or slope of which he does not particularize.

In laying out his drains, Mr. Longfield has always kept in view the employing them as small Canals, for the conveyance of gravel or manure through the Bogs; and as his district affords great facilities towards this important object, he has been enabled to accomplish it in many instances, his main drains being frequently carried from the foot of a gravel hill or mound of clay, through the adjoining tracts of Bog. He has also made provision for carrying into effect a system of irrigation, the efficacy of which he considers to be great in the reclamation of Bog.

Mr. Longfield's district appears to afford more instances of the improvement of Bog, than the others now under consideration; one instance we select as a practical example of the efficacy of a judicious system of drainage; it is related in the Report on the 12th division of the Bogs in his district.

Mr. Molloy, of Clonbealymore, he states, has most judiciously effected the drainage of about 170 acres of Red Bog, besides bringing into a profitable state a great portion of moor and bottoms round the Island of Clooneen. The quantity of drains which he found necessary is marked on the Map, affording a good specimen of the number that may be required for the drainage of the whole; but, however, we are to consider, that his surface drains were unassisted by any main tap, and therefore the Bog required more of them than will be found requisite when they are intersected by the great main drains proposed. Mr. Molloy's drains are not large, but numerous, being in general from 3 to 5 feet deep; and the effect of them is such, that the heaviest beast may pass over his Bog in summer-time.

Mr. Edgeworth does not approve of a general system of deep drainage; partly because he considers deep drains to be little more effectual than shallow, and partly because he disapproves of employing them as canals for conveying manures, being of opinion that the loading and unloading the boats, which must be done by wheel-barrows, would be too expensive. In lieu of canals, he has proposed wooden Railways, with carriages adapted to them, on a most ingenious plan of his own invention, as detailed in the Appendix to his Report. He therefore has not given levels for carrying such canals or deep drains through the Bogs of his district *(to which he expressly confines his opinions,)* but recommends, in preference, surface drains of smaller dimensions; the larger to be 5 feet deep and 3 feet wide, the smaller to be of 18 inches in depth, and of a breadth varying according to the wetness of the Bog. He also recommends, that the sides of the drains should be perpendicular, remarking, that in turf banks the sides which are perpendicular do not give way; the bottom or sole of the drain, he proposes to form in the shape of an inverted arch, so as to resist the lateral and upward pressure of the mass of Bog, and to form a narrow channel for the water, whereby its current will be accelerated, and will keep the drain free.

In detailing the account of an improvement effected by him in a Bog of 27 acres, Mr. Edgeworth remarks, that only a few slight surface drains of small dimensions were made, which sufficiently drained this Bog; but he also observes, that the Bog was inclosed with a seven-foot ditch, in part sunk to the under stratum of clay; and further, that the Bog having been in part cut out, its depth did not exceed four or five feet: this improvement therefore does not afford proof, that a similar system of drainage would be effectual in Bogs of so great a depth as 30 or 40 feet.

Mr. Edgeworth has recorded a remarkable occurrence, which is in favour of a system of deep drainage, wherever it can be effected without incurring too heavy an expense. The Bog of Rine, situated on the banks of the River Camlin, in the county of Longford, of an average depth of 35 feet, and having a considerable inclination towards the river, suddenly burst on the night of the 16th December 1809; great part of the soft stuff of which it was internally composed, slipped towards the river and into its channel, without carrying away the surface of the Bog, which however sunk considerably; the internal water of the Bog was let off, and about 20 acres of the surface, which had been so wet as to be scarcely

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passable, became completely drained in the course of a fortnight. The details of this singular fact are interesting in many points of view; and it shows, that where an exit is given for the waters of a Bog, at a considerable depth beneath the surface, the effect in draining the Bog is very rapid and considerable; probably from the pressure of the incumbent strata accelerating the issue of the waters.

Mr. Edgeworth has invented a plough (which he calls a Seton-plough) adapted to surface draining; it is described in the Appendix to his Report, and appears well worthy of attention: it has not yet been sufficiently tried to enable us to pronounce on its merits; experience will demonstrate how far it is applicable to the drainage of Bogs.

Mr. Richard Griffith junior, in his former Report, had recommended a system of drainage which should divide the Bogs into fields of ten Irish acres; he has since re-considered this part of the subject, and thinking that such divisions would be too large for convenience, and also that in certain situations the centre of the field might remain too wet for agricultural purposes, he now proposes that, in addition to the three classes of drains proposed in his former Report, a fourth class, which he calls *Surface* Drains, should be executed; and he places them at such distances, as, with the larger classes of drains, will divide the Bog into portions of $3\frac{1}{3}$ Irish acres.

His revised system of drainage, therefore, is as follows:

1st. Main drains in the lowest situations, their dimensions, 14 feet top, 2 feet bottom, and 12 feet in depth. 2d. Minor drains, falling into the main drains obliquely, and in such direction as will give the greatest fall to the water; their dimensions 9 feet top, 1 foot bottom, and 8 feet in depth; these minor drains to be sunk at the distance of a quarter of an Irish mile from each other. 3d. Intermediate between the minor drains, and parallel to them, Mr. Griffith proposes to cut drains of still smaller dimensions, viz. 6 feet top, 1 foot bottom, and 5 feet deep; and further at right angles to the minor and intermediate drains, a system of cross drains of dimensions similar to those of the intermediate drains, is proposed to be carried 280 yards asunder, which would divide the Bog into square fields of 10 Irish acres. Lastly, he proposes surface drains, of 4 feet breadth at top, 1 foot bottom, and 3 feet depth, intended to divide the 10 acre fields into three parts, by two drains to be cut parallel to the minor and intermediate drains, that is, in the direction of the fall. The whole of the foregoing drains would divide the Bog into rectangular patches of 280 yards long by $93\frac{1}{3}$ broad; and Mr. Griffith considers this general system of drains quite sufficient for that high and porous species of Bog which abounds in his district, and which in his description of the several species of Bog, he denominates "Fibrous or Red Bog."

To explain this system more clearly than by any general description, Mr. Richard Griffith junior has annexed to his Report an *enlarged* Map of Genshill Bog, exhibiting the main, minor, intermediate, cross and surface drains, all laid down in their proper situations.

Mr. Richard Griffith junior enters at large into the question of the proper form for drains, observing previously, that he has been induced to recommend the plan already detailed, from observing that similar drains made by the Grand Canal Company in the Bogs of his district, have answered perfectly well. The chief desideratum he states, in cutting Bog drains, is to form them in such a manner that they shall keep themselves clean, and that their sides shall have no tendency to fall in or collapse. The first of these objects he thinks may be obtained by making the bottom of the drains sufficiently narrow, that is, proportioned to the quantity of water which is likely to pass through them, and the sides may be prevented from falling in by giving them a sufficient slope; that which he has recommended is 6 inches increase of width on either side for every foot in height; thus the proposed dimensions of minor drains are 9 feet top, 1 foot bottom, and 8 feet deep. He observes, that the Bog drains which he has seen made with perpendicular sides, are always in firm Bog, and that in his opinion, it is utterly impracticable to form such drains in very wet Bog. Drains of this description have always a tendency to choak, as they must necessarily be made 3 feet broad at bottom (if the drain be 4 or 5 feet deep) to allow the workmen room to throw out the Bog stuff; their sides must also be expected to fall in, unless the Bog be very compact; even turf banks, which are always made in the driest and most compact parts of the Bog, he observes, frequently fall in in winter, and almost universally crack behind and hang over. In fact, every kind of Bog drain will in time become narrower at top than when originally formed; the drains made by the Canal Company, as before mentioned, were cut with a slope equal to what he recommends, and have now become considerably narrower at the top; had they been made originally with perpendicular sides, they must, he observes, have long since fallen in. He is induced further to recommend drains narrow at bottom from a consideration of economy, as they contain fewer cubic yards in a running perch of work, and the principal part of the excavation is at the surface where no pitching is required.

Mr. Townshend's plan of Drainage is formed on somewhat different principles; he has kept in view the formation of Canals, not only for the conveyance of manure towards the reclamation of the Bogs, but for permanent navigable communications between the Bogs and the great rivers adjacent. He has also formed his system of Drainage upon the idea, that it is necessary to retain the lower strata of Bog in a state of moisture, after the surface shall have been freed from water.

In determining on the levels best suited to these Bogs, Mr. Townshend has therefore calculated on retaining the surface of the water in the proposed drains at least on an average two or three feet below the surface of the Bog in summer, when there is 5 feet depth of water in the drains, and he proposes to make sluices and overfalls in every level or reach, in convenient places, where there is a natural fall towards the Shannon or any other river, for discharging the surplus water in times of heavy rains, and also for drawing off the water in the navigable drains, so as to reduce the depth to 3 feet only in the winter season; the surface of the Bog will then be 4 or 5 feet above the level of the water in the drains, and the depth of water, he states, will still be sufficient for the boats. This difference of level between the surface of the Bog and the surface of the water, Mr. Townshend thinks, will be fully sufficient to answer the purpose of agricultural improvements, and the proposed regulations of winter and summer levels will prevent the inconvenience of a want of water in dry seasons for the purpose of promoting vegetation, for the use of cattle and for irrigation, where that is practicable. Should the Bog subside too near the level of the water, the drains may be re-sunk; and Mr. Townshend prefers this to the sinking deep drains at once, they being more liable to collapse; he however does not think that the surface of the Bog will subside considerably, so long as the water is kept in the drains.

Mr. Townshend has laid out his main drains principally with a view, as it should appear, to their being used as Canals, and therefore has calculated on dimensions of 29 feet breadth at the water surface, 14 feet breadth at the bottom, and 5 feet depth of water. The collateral or minor drains he proposes to be 22 feet in breadth at top, 7 feet at bottom, and of a depth to give 5 feet water; these latter he thinks will be adequate to the purpose of Canals for carrying out manure, and for local communication: he recommends them in preference to the larger Canals, as sufficient for the present, and we are disposed to consider that drains even on a smaller scale will answer the purpose. The spaces on each side of the main drains and collateral cuts, he thinks, can very easily be drained by common drains, 6 feet wide at top, and 4 feet deep, at an expense not exceeding that of making proper fences for inclosing and dividing the Bog into convenient fields; the cuts are so laid out, that the intervening space seldom exceeds 80 perches Irish, or 560 yards in breadth.

We apprehend that Mr. Townshend has carried our instructions, in respect to the eventual conversion of main drains into navigable Canals, somewhat beyond our intention in the first instance. It would appear from his Report, as if the principal object of research were the intersection of the Bog in all directions with navigable cuts, and that the drainage of these wastes were only a secondary consideration; under this impression, we conceive that he retains the water in his navigable cuts, much too near the surface of the Bog to admit of complete drainage, and that he has laid them out, in the first instance, upon a scale far beyond what would be necessary to effect that prime object, and has thereby materially augmented their expense; to which must be superadded the necessary accompaniments of inland navigation, viz. Locks, Sluices, Aqueducts, inclined Planes, Embankments, &c. &c. to a very considerable amount. Whenever the Bogs shall have been perfectly drained, it will doubtless be a matter well worthy the consideration of the proprietors to obtain navigable communications with the main land, for the purpose of procuring gravel, lime, &c. and for the more easy and cheap conveyance to market of the produce of the Bogs; but as we conceive that this is only a matter for future consideration, no farther attention ought now to be paid to it, than may be sufficient to cause the main drains to be laid out in such directions as may not be inconsistent with the future attainment of so desirable an object.

The system of drainage which he proposes will, he thinks, answer for all descriptions of Bog; whether deep or shallow, the depth of the Bog or Peat he considers to be of no consequence in determining the position of the drains, which are to suit the level of the surface; nor does he conceive it at all necessary to sink them to the full depth of the Bog, with an intention of draining or tapping the water from it, because (excepting a few feet near the surface) the great mass of Bog or Peat he considers to be a substance impervious to water. This observation, however, appears in the subsequent part of this paragraph to be applied principally to black Peat or Turf, which is far more firm and close in its texture than fibrous or red Bog.

That description of Moss which retains most rain water, he says, has the quickest growth, hence we often find the softest parts of the Bogs in the most elevated places, and in many instances, even higher than the surrounding lands; and on the contrary, hard firm Bog on the lowest levels; which Mr. Townshend thinks is a convincing proof, that springs or rivers are not a principal cause of the fluidity of Bogs, but rather that they do not ascend into it at all. He states, in further corroboration of this opinion, that considerable tracts of Bog have their base much above the level of the natural outlets, and so that it is probable that any springs which may be underneath the Peat penetrate through the sand or porous strata, or the interstices of rock, into the adjacent rivers. The inference which Mr. Townshend draws from these premises is, that small drains, with levelling and trimming the surface will effect the purposes of drainage completely; and that the immense saving of expense, time and risk in execution, together with the conveniences and advantage they will afford, will make them preferable beyond comparison to the deep ones.

Mr. Jones also agrees in the extreme tenacity of the matter of which Bogs are composed, which causes the rain water to be retained on their surfaces, thereby chilling vegetation; he nevertheless considers that these Bogs can be easily drained, the outlets of waters being considerably lower than the surface. His main drains are laid out according to circumstances (at about 80 perches asunder) and the transverse drains crossing the main drains generally at right angles to them, are also laid out at the distance of 80 perches from each other; the principal consideration has been, to point them in such directions as to give the waters the greatest fall from the summit of the Bogs to their outlets or natural discharging points.

The main drains through the deep and wet Bogs, Mr. Jones proposes to be sunk from 14 to 16 feet in depth from the present surface, and to be 2 feet wide at bottom. The transverse drains to be sunk from 10 to 12 feet, and to be also 2 feet wide at bottom; to these be adds intermediate drains, midway between both the main and transverse drains, to be sunk 5 feet in depth. Wet Bogs, he observes, will not admit of drains of the above description, being sunk at once to their full depth, as the sides would have a tendency to close together, and the bottom to rise and swell up; time therefore must necessarily be given for the sinking. Mr. Jones has detailed in his Report a very simple mode of sinking drains of large dimensions, by working at intervals, and allowing the Bog time to subside. The Plate annexed to his Report explains this method clearly, and it seems applicable, with most advantage, to very wet Bogs, in which it will save the excavation of 58 cubic yards of Bog in every running perch of 21 feet; and by this manner of operation, he thinks the danger of collapsing will be avoided. He further recommends that frequent borings should be made in the drains with an auger of 3 or 4 inches diameter, to give vent to the springs, the beneficial effect of which he has frequently observed.

Mr. Jones conceives, that to form navigable Canals in the first instance through the Bogs, would interfere with their effectual drainage, and proposes therefore, that the main drains should not be formed into Canals until the drainage shall have been completed; at which period he thinks this plan will be advantageous: this observation we consider to be judicious, and are of opinion, that Mr. Jones's suggestion ought to be observed.

In draining a large tract of Bog, it is necessary to be cautious, lest the operation be carried too far; for it appears, that to render the surface of a Bog perfectly dry, would be prejudicial; there are limits beyond which its drainage must not be effected. Red Bog, as Mr. Richard Griffith junior observes, when first drained, is extremely porous and open in its texture, on which account it is liable to become so dry in summer, that the natural grasses die for want of moisture; but in process of time, the surface of drained red Bog, by exposure to the atmosphere is decomposed, becomes compact, and capable of supplying food and moisture to plants in dry weather.

Mr. Longfield is equally aware of this, and relates facts which prove that vegetation is completely checked on the Bogs by drought; he has therefore contrived his drains so, that when the Bog shall be reduced to a state of cultivation, they can be dammed up, and the water generally diffused over the surface, for the purpose of irrigation.

Mr. Townshend seems more apprehensive than any of our other Engineers, of the prejudicial effect of extreme drainage, so far, that besides his plan for retaining the water in his drains within a few feet of the surface, he proposes to take in several streams from the adjoining lands, in addition to the soakage from the Bogs, to ensure a sufficient supply of water in all seasons.

It is obvious, that if a general drainage of the Bogs in any District should be carried into effect, the neighbouring streams and brooks, into which the waters of the Bog will then be suddenly discharged, will be subject to frequent and violent floods; provision must be made to obviate this, by deepening the beds, and removing the obstructions in the channel of these small rivers, sufficiently to render them capable of effecting the quick discharge of the waters, without flooding the country, as otherwise, the injury that might be produced by the floods in the low lands would counterbalance the advantage of drainage in the Bogs. Our Engineers, where such operations appeared necessary, have given Plans for effecting them, with the proper Sections; and the expense is included in their respective Estimates.

They have also taken into consideration and described the proper sites for such Mills as may be necessary, and such alterations in the existing Mills and Weirs as may be required towards the draining of the adjacent Bogs.

It must be expected, that with whatever skill and attention the drains be executed, they will in many instances be exposed to accidents, and for the first few years at least, will suffer from the extreme wetness and want of compactness of the soil, by collapsing at the sides, and by the effect of surface rills of water, and of the heavy rains in winter time. It will therefore be necessary, after the drains shall have been executed, to pay attention to them for a certain time, that they may be kept open, and their channels afford a free course for the waters.

Mr. Richard Griffith junior recommends, that after the drains shall have been completed, the Bog should be suffered to remain for 18 months or perhaps two years, to subside; during which time, labourers should be employed under the direction of a competent overseer, to remove obstructions, and to keep the drains in perfect repair; and he has included in his Estimate the expense of this operation.

We are fully aware, and our Engineers seem equally impressed with the opinion, that it is impossible to lay down any general system of drains which could be accurately followed in every instance; local circumstances must always be attended to; the different degrees of the wetness of Bogs, the varieties in their texture affecting the degree of tenacity with which they retain water, the form of the surface giving different falls for the drains, and many other particulars must be taken into consideration; and every plan, however perfect in general, must arrange itself according to them. We therefore consider, that the differences in the Reports of our Engineers on this head, and the variety of opinions as above stated, so far

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from being a subject for doubt or objection, in fact render their Reports more valuable; what is suggested by one may apply better to a particular case than the plan of another; and the very discussion to which their differences of opinion will probably lead, we think will finally prove of advantage. Upon these principles therefore, we are of opinion, that neither deep nor shallow drainage is to be exclusively preferred, but that wherever extensive Bogs are to be drained, main and minor drains will be required for the purpose, to act as receiving drains for the water, which a system of numerous small surface drains must collect in considerable quantities; and we are inclined to consider that a plan of drainage embracing a system of main, minor, and surface drains, will be found most universally applicable.

We also conceive, that it may hereafter in many instances be desirable to combine with the drainage of the Bogs, a system of internal navigation, on a very reduced scale, for the conveyance of gravel and other manures to the Bogs; and we look upon Mr. Edgeworth's invention of wooden Railways and Carriages, and Mr. Townshend's plan for using light Waggons on floats, as valuable auxiliaries towards this important step in the progress of the reclamation and further improvement of Bog.

Agricultural Reclamation of Drained Bog.

ON this important part of the subject some of our Engineers have furnished us with much detailed and highly valuable information. Mr. Professor Davy has also been so obliging as to give us the general outline of his opinion on the subject: his Answer to a letter from our Secretary is subjoined as the 10th Article of our Appendix.

Mr. Richard Griffith junior has suggested to us different processes by which the drained Bog may be brought into a state of Reclamation applicable to several purposes, and yielding various degrees of profit, corresponding to the different rates of expense proposed to be incurred, accompanied by very detailed Estimates of the expense, and of the profit that may be expected, founded upon the result of numerous inquiries as to the modes which have been pursued, and the costs of the various improvements already effected. These Observations and Estimates appear to us to be well worthy of attention. He begins, as has been already observed, by recommending, that after the several drains shall have been completed, the Bog should be suffered to remain for eighteen months or perhaps two years to subside, during which time it will be necessary to employ a sufficient number of labourers under the direction of a competent overseer, to remove obstructions and to keep the drains in perfect repair, and in estimating the drains he has increased the price per cubic yard in order to cover this expense. The next step which he recommends, is, to form roads along the edges of the drains, sufficiently strong to bear the weight of small carts; the superior advantage in this process to be derived from Mr. Edgeworth's plan of wooden moveable Railways, is, we think, very considerable. Mr. Richard Griffith junior next considers the quantity of manuring gravel which would be sufficient to cover an acre of Bog, in order to render it capable of producing a good crop of Rape, Potatoes or Oats, or rather a succession of those three crops, without any further addition of manure than the ashes that would be produced by a light or a partial burning of the surface; he supposes that six loads to the perch of gravel (each load containing about seven hundred weight) would be amply sufficient to cover each acre, together with a slight top dressing of ashes, or (if more convenient) of quick lime, say one thousand loads, or three hundred and fifty tons of gravel to the acre, he calculates that upon a general average, each load could be laid on the Bog at an expense of about four-pence per load, or £. 16. 13. 4. per Irish acre, and the top dressing of caustic lime would cost about £. 6 per acre more, to which add the expense of planting and digging out an acre of potatoes, which be recommends as the first crop, £. 10. He proposes a second crop of potatoes to follow the first, in which case the produce of the second year, he observes, will be found greatly superior to that of the first. The third year a crop of oats, and to lay down the land with hay-seed. For the fourth year meadow, without any additional expense. Mr. Richard Griffith junior adds, that if he is not greatly mistaken, the Bog so treated would be completely reclaimed, and would in its then state, be well worth £. 1. 10. per acre per annum.

There is however another rotation of crops, which he says he would prefer to the foregoing, and which is also frequently practised, with the exception however, that the large quantity of clay and gravel which he recommends, is seldom or ever afforded to the Bog in the first instance, and on which increased quantity he builds his expectation of perfect reclamation, by forming a solid upper stratum on the Bog, without which the plough can only operate at particular seasons; for this purpose he proposes, that after the one thousand loads of gravel, as above stated, shall have been laid out and spread, the whole should be lightly ploughed, and after a slight top dressing of lime or of red ashes, which latter may be easily produced by burning the surface of the nearest black Bog, a crop of rape should be sown, to be succeeded with one crop of drill potatoes, oats and meadow, and as soon as the hay shall be mowed, about two hundred and fifty loads of gravel or clay per acre should be laid out and spread upon the surface; this process, he adds, would leave the land (for such it might be then called) in a state of great power and vigour, and infinitely more profitable to the farmer for tillage, meadow or pasture, than most of the uplands in the neighbourhood. He is of opinion, that after the above process, including the second top dressing of gravel, the value of the Bog to the farmer would far exceed (although he states it at no more than) £. 1. 10. per Irish acre.

He next lays before us a Prospectus of the probable Expense of the two modes of cultivation above suggested, together with the annual Return to be expected from the several crops in the process of four years cultivation; and for the purpose of perspicuity, he makes his estimates upon a single average acre, and afterwards forms his conclusion upon the result of four hundred acres under similar treatment.

First proposed rotation of Crops.

1st year - - - Potatoes.
2d d° - - - D°.
3d d° - - - Oats laid down with Hay-seed and white Clover.
4th d° - - - Meadow.

Second proposed rotation of Crops.

1st year - - - Rape.
2d d° - - - Potatoes in drills.
3d d° - - - Oats laid down with Hay-seed and white Clover.
4tb d° - - - Meadow; immediately to be followed by a slight covering of gravel.

D^r and C^r on first proposed rotation of Crops.

D^r, or OUTLAY.	£.	s.	d.	£.	s.	d.
First year.						
Putting out 1,000 loads (7 cwt. each load) of gravel per acre, at 4*d*. per load - - - - - - - -	16	13	4			
Spreading the gravel - - - - - - - -	0	10	—			
Top dressing of lime - - - - - - - -	6	—	—			
Seed, eight barrels, at 5*s*. per harrel - - - -	2	—	—			
Planting, second covering, digging out and gathering -	8	—	—			
per acre - -	33	3	4			
Add Interest, for nine months on £. 33. 3*s*. 4*d*. at 6 per cent. per annum - - - - - - - -	1	9	10			
				34	13	2
Second year.						
Seed-planting, second covering, digging, and gathering, per acre - - - - - - - - - -	-	-	-	10	—	—
				44	13	2
Third year.						
Two plongbings and barrowings - - - - - -	2	—	—			
Harrowing with grass harrows, and rolling after the sowing of the hay-seed - - - - - - - - -	—	15	—			
Seed Oats, 1 ½ barrel per acre, at 15*s*. per barrel - -	1	2	6			
Hay seed and white Clover:						
12 barrels of white Hay seed - - - - £. 1 16 0						
12 lb. of red, and 4 lb. of white Clover - 1 2 9	2	18	9			
Fonrth year.				6	16	3
Meadow - - - no expense.						
Total Expense of 4 years cultivation, per acre - -				51	9	5

C^r, or RETURN.	£.	s.	d.	£.	s.	d.
First year.						
60 barrels of Potatoes, at 5*s*. per harrel - - -	15	—	—			
Second year.						
80 - - - D° - - - at 5*s*. per barrel - - - -	20	—	—			
Third year.						
14 barrels of Oats, at 14*s*. per barrel - - - Besides Straw, which pays for reaping, threshing, &c. &c. &c.	9	16	—			
Fourth year.						
Meadow; the price at which it wonld set per acre -	5	—	—			
Total Return from four years cultivation, per acre - - £.				49	16	—
Total Loss on four years cultivation of Bog, per acre - -				1	13	5
£.				51	9	5

After which the ground will set for at least £. 1. 10. per acre per annum.

Dr and Cr on second rotation of Crops.

		£. s. d.	£. s. d.
Dr, or OUTLAY.			
First Year.			
Putting out 1,000 loads (7 cwt. each load) of gravel, per acre, at 4*d.* per load - - - - - - -		16 13 4	
Spreading Do - - - - - - - -		— 10 —	
Lime or red ashes - - - - - - -		5 — —	
Spreading the lime or ashes - - - - - - -		— 5 —	
One ploughing - - - - - - - -		— 18 —	
Rape seed and sowing - - - - - - - -		— 5 —	
Add, Interest on the above Outlay for 18 months, at 6 per cent. per annum - - - - - -		2 2 5	
			25 13 9
Second year.			
Potatoes in drills - - - - - - - - -		- - -	
Two ploughings and harrowings at and before sowing -		2 — —	
Drilling; dropping the sets, and covering the seeds - -		2 — —	
Seed; six barrels to the acre, at 5*s.* per barrel - -		1 10 —	
Hoeing with the plough, and landing - - - -		1 — —	
Ploughing out and picking - - - - - -		1 — —	
Expense per acre - -		- - - £.	7 10 —
Third year.			
Oats; the ground to be laid down with Hay seed and Clover, as in the first mode in the third year.			
Expense per acre - -		- - -	6 16 3
Meadow; after the Meadow is cut, I should recommend about 250 loads of gravel per acre to be spread on the grass, to make up for the gravel consumed in the first turning - - - - - - - - - -		4 3 4	
Spreading and picking - - - - - - - -		— 10 —	
Expense per acre - -		- - £.	4 13 4
Total Expense of 4 years cultivation and improvement, per acre		£.	44 13 4
Cr, or RETURN.			
Produce of First year.			
12 barrels of Rape seed, at 34*s.* per barrel, per acre - - - - - - - -	£. 20 8 0		
Deduct reaping and thrashing - - - -	1 10 0		
		18 18 —	
Second year.			
80 barrels of Potatoes, at 5*s.* per barrel - - - - -		20 — —	
Third year.			
14 barrels of Oats, at 14*s.* per barrel - - - - -		9 16 —	
Fourth year.			
Meadow; the price of which it would let - - - -		5 — —	
Total Return from 4 years cultivation - - - - -			53 14 —
Deduct Total gain for 4 years cultivation of Bog, per acre -			9 — 8
		£.	44 13 4

From the foregoing prospectus it would appear, that upon the second rotation of crops (which Mr. Richard Griffith junior considers to be the best for the ground) there would be a clear profit of £. 9. 0. 8. per acre on the general result of four years cultivation and improvement, being nearly equal to two guineas per acre per annum; Mr. Richard Griffith junior adds, that fearful lest be should have drawn too flattering a picture of the undertaking, he has gone over every article in the foregoing Estimates, both of expense and produce, with some very experienced and discerning farmers, and has not been able, after a thorough investigation to correct them in any respect; as however it may be apprehended, that in farming upon a large scale, the expense may be increased beyond the best

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considered estimate formed upon a small one, he therefore has thought it expedient to increase the amount of the Outlay, by an addition of 10 per cent. to the estimate, and to subtract 10 per cent. from the produce of the crops, as an allowance for partial failures arising from inclement seasons. And he says he feels satisfied that by so large an allowance (making on the whole concern a deduction of profit amounting to 20 per cent.) he has made ample provision for every possible contingency.

According to this Statement, the Account will stand thus:

	£.	s.	d.
To amount of Outlay on second rotation of Crops, as per prospectus, per acre - - - - - - - - -	44	13	4
Add 10 per cent. - - - - - - - - - -	4	9	4
Total Amount of Outlay - - £.	49	2	8
To amount of Return per acre, as per prospectus - - -	53	14	—
Deduct 10 per cent. - - - - - - - - -	5	7	5
Total Amount of Return - - £.	48	6	7
Loss on 4 years cultivation - - - -	—	16	1
£.	49	2	8

From hence Mr. Richard Griffith junior observes, that on four years cultivation there will be a loss of 16*s.* 1*d.* per acre, to which must be added the expense of drainage; viz. £. 1. 16. making a total loss of £. 2. 12. 1. per acre, which would be the full purchase paid for bringing unprofitable red Bog to the value of at least £. 1. 10. per Irish acre, or 18*s.* 6*d.* per English acre per annum for ever. Let this estimate then be compared with the important object to be attained; viz. 400 acres of unprofitable red Bog converted into ground well worth £. 1. 10. per acre per annum, and the final account will stand thus; viz. 400 acres at £. 1. 10. per acre, amounting to £. 600 per annum, estimated at 18 years purchase, makes - - - - - - - - - - - - - £. 10,800 — —

Deduct £. 2. 12. 1. per acre on 400 acres -	1,041	13	4
Net Profit - - -	£. 9,758	6	8

Mr. Richard Griffith junior proceeds to give us his opinion on the applicability of Peat soils to white and green crops respectively, and observes, that there is a natural disposition in all plants towards particular soils, or in other words, that the food of certain plants is found more abundantly in one kind of soil than in another. From the observations he has made on the growth and perfection of different plants on boggy and moory soils, he is fully persuaded that they are infinitely better adapted to produce and mature green than white crops. The finest cabbages, turnips, carrots and parsnips, he has ever seen having been raised in gardens made in black Bog, with no other manure than a slight sprinkling of ashes produced by burning part of the same soil; and potatoes, he says, have such an affinity (if the expression may be allowed) for Boggy soil, that farmers always prefer planting the seed that has been raised on Bog to any other, and frequently send to a considerable distance to obtain it; on the other hand he has found, that although the crops of oats and wheat produced on peat soils have been sufficiently luxuriant, yet they have seldom yielded in proportion to their promise, the grain being neither so full nor so bright as that produced upon good upland. This circumstance, however, he states may have arisen in a great degree from the want of a sufficient admixture of limestone gravel, or other calcareous matter, a corrective always at hand in these Bogs, which, when applied in sufficient quantity, is invariably found to produce the most beneficial effects, and *vice versâ,* as Bog stuff, exposed for some months to the atmosphere, well turned, and mixed with common earth and a small portion of caustic lime, is found to be an excellent manure for worn-out upland. He further observes, that were he to point out the most advantageous situation for a judicious and extensive farmer, he should place him on the margin of a Bog, upon which he should raise all his green crops, and the whole of the dung produced in the farm-yard by cattle fed on turnips, &c. might be applied to the improvement of the uplands, and he is fully persuaded (that if ever any extensive plan shall be put into operation for draining the Bogs) that not only the system he has just now suggested will take place, but a very considerable traffic will arise in the manufacture and sale of ashes, which will prove equally beneficial to the Bog improver and to the upland farmer.

He further states, that the foregoing system, although extremely profitable in the end, would, however, require a considerable capital to carry it into execution upon an extensive scale; and that it is almost unnecessary to observe, that the want of capital is the great obstacle to the internal improvement of Ireland. It may not therefore, he says, be improper to suggest a mode of rendering the Bog when drained of considerable value, by a more simple and less expensive process.

If the surface of the drained Bog, he observes, be suffered to remain inactive for three or four years subsequent to the drainage, a thick crop of common heath will be found growing on its surface intermixed with grass. This heath, and the decomposed Boggy soil which is immediately below it, he proposes should be ploughed up, gathered into rows, and burned; after which operation the surface of the Bog should again be ploughed lightly, the ashes spread, and rape seed sown; the rape should not be suffered to go to seed, but should be eaten off by sheep. After light ploughing and harrowing, grass seeds might then be sown, which in the course of a year would become excellent food for sheep and young cattle, but meadow should not be attempted. After a few years it may be expected that heath will again make its appearance, the process already described may then be again resorted to; viz. ploughing, burning, rape crop, grass, and the second crop of rape will be found to be greatly superior to the first. The expense of rendering the surface of the Bog valuable, by the means last described, he says will be trifling, and will be amply repaid by the value of the rape crop, and the Outlay will be returned in less than a year.

Mr. Richard Griffith junior says, that in the improvements already effected, rape appears to be the most favourite crop, at least in the commencement, but oats, potatoes and rye, are found to answer nearly as well. He has seen wheat tried on the surface of very deep red bog; the produce was tolerably good, but the grain was not full. Hemp had been tried by many persons with various success; when failures had occurred they were perhaps attributable more to ignorance of the mode of cultivation, and the proper methods of saving and drying, than to any imperfection in the peat soil. He observes, that this plant likes a deep soil, but will not thrive in wet; unless therefore the Bog shall have been completely drained, the soil to some depth turned up and exposed to the atmosphere, and intermixed with limestone gravel, there can be little hope of obtaining a valuable crop; but with these precautions he thinks the best success may be expected.

Mr. Jones observes, that throughout the whole of his District few attempts have been made towards the reclamation of any considerable part of the large tracts of Bog which it contains. The principal places that have been improved are at Toar, Middleton, Kilbresman, Tyrrell's Pass, and Killduff near Philipstown; the whole extent reclaimed does not exceed two hundred acres. He states, that the mode usually pursued in the reclamation of such parts of Bogs as have come under his observation, was, after the space had been well drained, the surface in general was either pared off, or ploughed or dug up and thrown into heaps (if black Bog) through which a quantity of gravel or clay was mixed. These heaps were then fired, and the ashes afterwards spread on the surface, and either dug or ploughed in. This produced an excellent crop of rape; crops of potatoes and oats succeeded this, after which it was generally laid down with grass seed, and by the application of such manures as were most convenient, produced very good crops of meadow. He observes, that in spongy red Bogs, the process of burning is not usually pursued; the surface when dry being so light that little ashes (and those of inferior quality) would be produced. Marle in this instance (if to be had) is the best manure that can be applied to the surface, a thin layer of which would be sufficient to produce potatoes, oats, flax, &c. in succession.

Mr. Edgeworth states an experiment made by himself some years ago upon Bog that had been only partially drained, whereby it appears, that by the application of lime, limestone gravel and marle, in the course of 5 years cultivation, he brought 27 acres of Bog, which when first taken in hand was not deemed worth half a guinea per acre, to be worth and actually let for £. 1. 10. per acre per annum. He states, that during the 5 years process of cultivation, he had charged himself with half a guinea per acre per annum rent, and that by an accurate account of the transaction now in his possession, it appears that he had never had £. 100 capital employed therein. That after having his capital reimbursed, and after the payment of rent and every contingent expense, including wear and tear of the implements of husbandry and overseers wages, he had at the end gained £. 17 clear profit; and at that period, when the land was in meadow he had let it to a farmer (who had formerly refused to take it at half a guinea) at 30 shillings per acre per annum for the farmer's own life, and he states that it is now worth nearly double that rent.

The observations suggested by Mr. Edgeworth in the reclamation and improvement of Bog, and the process recommended by him to be pursued therein, are as follow: In the first place, he proposes to cut off all the springs and sloughs by appropriate drains, and then wherever a Bog, as that denominated No. 8, in his district, is covered with heath or weak plants of any other sort, he advises the burning off the rough surface in a dry summer, merely by setting fire to the heath, and permitting the fire to spread itself wherever it may meet with fuel. In other Bogs, where the roots of plants are strong and deeply sunk under the surface, he would immediately proceed to turn up the whole of the Bog with grubbing tools, and particularly with a long loy, a tool which is common in the western part of Ireland. As he advanced, he would cut narrow drains of 18 inches deep with Essex draining tools, *wherever* water lodged on the surface, and drains of fit dimensions wherever springs occurred, not previously discovered. The thick tough surface of the Bog should then be piled up in ridges to dry, and where the turf so dried yielded ashes that contained manure, as much of it as is possible should be burned in the rows as they stand, to save the expense of making it into heaps. What remains unburned after this attempt should be collected in heaps, and burned to ashes. The next operation is to put out some kind of clay upon the ashes after they have been spread, taking care soon to cover them with earth, to prevent them from being blown away.

Mr. Edgeworth does not approve of a system of navigable drains, for the transportation of the proper manures into the Bogs, but proposes to employ for this purpose portable Railways shod with iron, with appropriate carriages; the latter are made to be emptied at

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either side of the railway, and when loaded with half a ton of earth, one of them can easily be pushed forward by one man; Mr. Edgeworth says he showed a railway constructed upon the above plan to several of his friends in 1787. The advantages proposed by this construction, were, to extend the use of railways to temporary purposes, and to reduce the expense considerably, by dividing into several parts the weight which is usually loaded on one carriage, so that the railway might be reduced in weight and cost, without being more liable to break than those that are in common use. Mr. Edgeworth adds, that this plan has been adopted in many places, particularly at Penrhyn slate quarry in Wales, where a number of small carriages loaded lightly supply the place of one larger carriage; by these means, railways may now be made sufficiently strong, though not one-fourth part of the weight or cost of ordinary railways. Mr. Edgeworth proposes that these portable railways should be supported on piles of five or six feet long driven into the Bog; and that they should be removed from place to place, so that after a series of railways had been laid to the distance of half a mile for instance, and after the carriage had emptied its load on each side of it, the railway may be detached and placed at the distance of two perches parallel to its former situation. We consider the suggestions of these railways as one of great utility, and which it will probably be found may be adopted with great advantage in the plans recommended by the other Engineers. The Plans and Estimates for their construction may be found in the Appendix to Mr. Edgeworth's Report, No. 4. By this it appears, that the proportion per acre of the capital of £.500, to be expended in making the railways and carriages, would on 1,200 acres amount to about five shillings per acre; wear and tear about three shillings more; gravelling and removing machinery about 10 shillings. Mr. Edgeworth next observes, that this Estimate is made on the supposition, that the machines and railways would last 4 or 5 years, the time necessary for completing the improvement of 1,200 acres, so as to make the land worth 30*s.* per acre; the expense of the whole, Mr. Edgeworth thinks would be nearly as follows:

	£.	*s.*	*d.*
Wear and tear, and share of capital, per acre - - -	—	8	—
Draining - - - - - - - - - -	—	10	—
Turning up surface - - - - - - - - -	2	13	—
Digging and filling clay - - - - - - -	2	13	—
Carrying out clay on moveable railway - - - -	1	14	—
Spreading clay and shifting the railway - - - -	—	10	—
Damages for gravel-pit - - - - - - -	—	7	—
	£.8	15	—

Equal to £. 5. English, per English acre.

To improve the Bogs of the whole District, amounting to 34,569 English acres, would according to this Estimate, cost £. 167,648 English. Thus a permanent income of nearly £. 30,000 English, could, he says, be obtained at less than six years purchase.

Mr. Edgeworth considers the plan that is here recommended as the first stage of improvement, and believes that it would make the Bog worth 25 or 30 shillings per acre, and he adds, that substantial and intelligent farmers would, for half as much more, double its value; but that poor tenants, if they were allowed to have more than a garden, and as much land as would support a cow with grass and hay, would soon wear out what had been done. Reclaimed Bog, he says, must be continually attended to; and if peat that will afford red ashes is to be found below the surface, and lime in any form be within reach, the Bog may be made worth four pounds per acre.

Mr. Longfield commences his observations on the improvement of Bogs, by stating, that in his district he has found good manuring gravel, sufficiently near the surface, to be raised without incurring much expense or trouble, and has accordingly noticed them on the Map, and would recommend, when such cases occur, that the stuff should be raised to the surface; but when the manures cannot be had nearer than 8 or 10 feet, he would not advise any attempt to diffuse their benefits.

He observes, that the different lines of drainage which he had recommended would be sufficient to reduce the surface of the Bog to a state of consolidation; but that this would not be sufficient alone to produce vegetation; the aid of manures is indispensable. On Moors and black Bog, the want of compost or manuring gravel would not be so severely felt, as that description of Bog produces strong ashes, by means of which the landlords are enabled to raise profitable crops of rape, potatoes, &c. &c. But as this species of manure is unattainable in the shaking or red Bogs, methods must be devised either to raise the under strata to the surface, or to convey into the interior such gravel or manures as the surrounding country affords; this last resource, with a few exceptions, is in Mr. Longfield's opinion the most practicable, and even this cannot, he thinks, be carried into effect without considerable labour and expense. However, the magnitude of the undertaking, and the benefits likely to result from it, have induced him to take advantage of the natural capability of the country, in affording means of conveying manuring gravel to the interior of the Bogs by the aid of navigable cuts; and therefore, wherever gravel may be had with a supply of water to command the summit of the Bog, Mr. Longfield has, in laying out the main drains, kept in view the further object of converting them into future lines of navigation, applicable, however, only to such purposes.

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Mr. Longfield further observes, that the Bog stuff raised in excavating for the navigable drains might be converted to profitable purposes, it might be brought to the Bog edges in the boats returning for a supply of gravel, and drawn from thence upon the uplands; he has seen the best crops in the country produced on light gravelly soils by this means only, and he is assured by gentlemen of respectability, that this species of manure is so valuable and certain in its effects, that it is generally used upon the uplands, not only bordering on the Bogs, but frequently at a distance of half a mile and more, until the carriage, according to the present mode, becomes more expensive than the species of return would compensate; and he states, that the value of Bog stuff is further exemplified in the interior of the country, by the care with which the turf mould at the bottom of the turf stacks is collected and spread upon the land with a small portion of lime or clay mixed with it. This compost is used with success in rearing garden stuff, such as cabbages, carrots, parsnips, &c. &c. And he is convinced, that if the inhabitants of the country were induced, when going for the Bog stuff, to bring a load of gravel with them, they might thereby have reclaimed many hundred acres round the verge of these Bogs, which, lying immediately adjoining the natural tops of the country, did not require a preparation of expensive drainage.

Mr. Longfield says, that the erection of locks in these deep bogs, is, in his opinion, entirely out of the question (where it is necessary to convey the manure from a higher to a lower level, he thinks we must be content with landing-places, in proper situations, by means of which, a load of gravel may be transferred from the boat on the higher level, to the boat on the lower one), which in most cases will not be found necessary, as either levels will generally commence or terminate in manuring gravels. He says, by these means manures can be diffused over the surface at a reasonable expense, when compared with that of horse work. Mr. Longfield states, that the quantity of surface which may thus be brought into cultivation will be great; for supposing that the operations of men with wheel-barrows, &c. cannot be extended more than 40 perches from the verge of the Canal on both sides, yet the quantity brought into improvement will be 160 Irish plantation acres, equal to 240 English acres in every Irish mile of navigation. The fee of which 160 acres, at the reasonable rate of 30 shillings per acre, at 5 per cent, would amount to £. 4,800, on the presumption that the effects of the navigable drains were confined to within 40 perches on both sides, but which can never be the case, when it is considered that their influence, combined with the surface drains, must extend much further, by means of which the gravel can be conveyed by cattle, either by back loads, or on sledges drawn over the pastures already formed by the labour of men only.

It is scarcely necessary for us to observe how useful an auxiliary to this system, Mr. Longfield would find in Mr. Edgeworth's plan of moveable railways.

The dimensions which Mr. Longfield proposes for those canal drains are fourteen feet at bottom, and to contain four feet depth of water; the boats to be flat-bottomed, and calculated to contain from fifteen to twenty tons, they would then be easily removed from place to place by one or two men. He says, that a navigation of this size, where no great surge of water would be occasioned to injure the sides, would keep in repair a considerable time, the advantages of which he calculates to outbalance any other mode whatsoever. To facilitate the object and save expense, he observes, there may be occasions for a few Bridges over the navigable drains, which can be made of Bog timber; all other passages over the main drains may be reserved, by only perforating the bottom, and leaving the surface untouched, as already alluded to in the small surface drains.

He observes, on the subject of improvements already effected, that the black and red Bogs held by Mr. Sadlier under Lord Digby, containing about 343 acres, being most judiciously intersected with main and cross drains (on a small scale), are now for the most part in a perfect and profitable state of agriculture, so much so, that a great portion of those Bogs, which when taken by Mr. Sadlier, were not worth five shillings per acre, would now produce from thirty to forty shillings the Irish acre. Mr. Longfield states, that the progress of this improvement consisted chiefly in draining, levelling and burning, by which means Mr. Sadlier has been enabled to rear abundant crops of rape, on an average from seven to ten barrels per acre, which, at the moderate rate of one guinea and a half per barrel, must have amply repaid his expenses, independent of creating a valuable and lasting property, which he now enjoys. Mr. Longfield also mentions the successful endeavours of Mr. Curtis, in reducing to a state of consolidation, a large portion of red and black Bogs, little less than 150 acres, a great part of which has been brought into cultivation within the last 15 years, and which at this moment are actually under sheep, and the remainder ready to receive any agricultural improvement.

Mr. Longfield says, that considerable improvements have been effected by Mr. Armstrong at Balever, Mr. Berry of Cloneen, and Mr. Woods of Garbally, which latter gentleman's improvements are by much the most extensive, amounting to near 240 acres, which being favourably interspersed with gravel hills, were more readily brought into cultivation. These, with their other natural capabilities, have been taken advantage of by Mr. Woods, who has now the chief part of his Bog in a most promising state of improvement. Much credit is also due to Mr. Berry, for his exertion and perseverance in tapping the Bog of Cloneen, by which he has completely drained several standing pools that contained from three to five feet water. He has also made some skreen plantations on the Bog that appear very healthy.

Mr. Longfield states, that in the middle of the Bog of Derrinlough, on the side of the road between Crankree Bridge and Derrinlough, there is a remarkable instance of the possibility

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of changing the nature of actual red Bog from an unprofitable to a profitable state; it consists of a few perches, which, as far as Mr. Longfield could learn, had been cultivated by a poor man 11 or 12 years ago, and which (contrary to the received opinion, that Bog will revert to its original state of nature) actually produces good pasture to this day, although deserted and left in common with the rest of the Bog since the improver's death, notwithstanding the peculiar disadvantages of the place being above a quarter of a mile distant from the main land.

Mr. Townshend observes, that the whole of his district abounds in limestone gravel, and that the navigable drains proposed by him will afford the easiest conveyance possible; they are in many instances directed to the foot of steep gravel hills of from 50 to 80 feet in height, and of an inferior quality of ground, in order that a sufficiency may be procured with the least possible injury to the adjoining lands. One acre, he observes, of a gravel hill 50 feet in height, will cover 600 hundred acres of Bog one inch thick, and so in proportion. Taking the gravel hills at an average of only 30 feet in height, which is a low calculation, the one acre will cover 360 acres of Bog one inch thick; and supposing the broken ground to be afterwards totally useless, the purchase of an acre could not exceed £. 36, which would amount to 2 shillings per acre on the surface of the Bog, for damages of the ground from whence the limestone gravel is to be procured.

The plan which Mr. Townshend recommends for bringing the gravel into the Bogs, is to have flat-bottomed boats, with a platform even with the gunnel, and a double railway upon it, calculated for two rows of waggons or carriages to be constructed for the purpose, and over this, if necessary, another platform may be erected with a single railway upon it, having sufficient headway for the lower tier; a sheet cast iron railway to be laid on the ground between the gravel hill and the boat, for the waggons to run on, and when as many are placed on the boat as the railway on the platform will contain, two men will take the boat along the drains into the Bog, and then to have another railway, not exceeding 40 perches (280 yards) to run the waggons from the boat to any part of the surface; then to tilt them, and return with them empty, and as soon as they are all replaced on the boat, to return with it to the gravel hill, and repeat their operations.

Mr. Townshend further observes, that cast iron railways and waggons could be very advantageously used along the exterior edges of the Bog where gravel hills are convenient, and also in the small detached Bogs and other places that cannot be accommodated with a navigable drainage and boats.

Mr. Townshend observes, that the facility with which gravel can at any time be brought in by boats, renders it unnecessary to lay on more in the first instance than is really required to produce one crop, then to go on progressively increasing the quantity with each succeeding crop, until the Bogs are gravelled completely to any thickness, and they will become profitable from the first commencement of the business, instead of having to wait for the full quota of gravel before the crops are put down, and will not require so large a sum to be laid out at the first onset; Mr. Townshend has calculated one inch only of gravel, as being sufficient to produce a succession of crops, but not for a permanency; the quantity per acre will be nearly 218 cubic yards, which, at the rate of 6*d.* per yard for excavating and removing by boats, will amount to £. 5. 9*s.* per acre.

He also states, that the value of the Bog when drained and gravelled, provided it be properly done, will be nearly equal to that of the adjoining lands; and these in general may be averaged at upwards of two guineas per acre per annum; the Bogs therefore, when improved in the manner before-mentioned, with the advantages also of a canal conveyance to every part, he thinks may be estimated worth 30 shillings per acre yearly value at the least.

Mr. Townshend then proceeds to make the following Abstract of his calculations: "The aggregate expense of draining and improving all the Bogs in this District, including navigable drains, and opening a communication with the neighbouring country, will be as follows; viz.

	£.	*s.*	*d.*	
The navigable drains - - - - - -	3	—	2	
Masonry on d° with inclined planes on the collateral cuts	—	17	7	
Gravelling the Bogs 1 inch deep - - - -	5	9	—	
Drainage to lands - - - - - - -	—	2	—	
	£. 9	8	9	per Irish acre.
Which is equal to - -	£. 5	16	5½	per English acre.

Mr. Townshend goes on to state, that when once the drains are made in the manner before-mentioned, any future improvements on extensive tracts of Bog can be done much cheaper than by any other plan; and those persons who undertake to reclaim and cultivate them may very well afford to pay, by an acreable rent, for the convenience of navigation, from which they will receive so much benefit.

Mr. Townshend mentions a fact which may be worthy of notice, in respect to the reclamation of red Bog; he says, that a considerable part of the Bog of Bunnahendley, which extends nearly to the town of Athlone along the banks of the Shannon, and whose depth is from 23 to 33 feet, with a gradual descent from the surface of the Bog to the River, has by degrees been reclaimed; and it appears at the time of the Down survey, that this Bog contained 1,173 acres; it is at present no more than 666 acres, a considerable extent of the red Bog having been improved.

With respect to the advantages of irrigation in the reclamation of Bog, we observe, that Mr. Edgeworth, Mr. Longfield, and Mr. Davy, all lay great stress on its beneficial effects; when it can be obtained from external rivers, there can be no doubt, but we think it highly material to observe, that the penning up the Bog water in the drains, and suffering it to spread over the surface of the Bog, may probably be found to produce widely different effects, as the Bog water is known to contain peculiar properties, which may be found injurious to vegetation.

As a practical proof of its efficacy, he adduces the instance of the river Clodagh, a constant stream running from the Slieve Bloom Mountains, and carrying with it quantities of fine sand and clay, which it deposits along its course. The effect of the sand thus deposited on the Bog is such, that the verges of it, which have been annually flooded for ages past, are now become good meadow, pasture and tillage, on sand and clay, under which there are in many places from 10 to 12 feet of Bog. He also states another fact, which proves, that these profitable verges have been made so by the effects of the Clodagh; namely, that the bed of the river itself rests on Bog of from 8 to 10 feet deep; this he has proved by boring in the centre of it, where, after passing through a stratum of gravel of 2 feet, he found a stratum of Bog 10 feet deep, which he thinks proves that the present course of the River is new, and that it must have been diverted into its present course since the formation of the Bog; for these reasons, Mr. Longfield recommends taking a supply of water from the Clodagh, to be used at all seasons if necessary.

The sub-strata of all these Bogs, Mr. Longfield says, appears to be a solid mass of clay mixed with limestone gravel, the latter not unfrequently covered with a thin stratum of clay or marle; but however desirable it may at first appear, that manures should be found under the surface of the Bog, which they are fitted to reclaim, the depth at which they lie will in most instances render this circumstance of little moment; fortunately, however, the boundaries of almost all these Bogs consist of hills of limestone gravel, as also generally the islands which rise in so many places through their surface. In our last Report we observed, that there was no spot, on the whole extent of these Bogs, above two Irish miles from the upland and cultivated districts; this is a circumstance of great moment, when we consider, that these boundaries generally present the manure that can be desired. It must not however be supposed, that it will often be necessary to bring the manure from so great a distance; for it is a singular fact, that owing to the indented and irregular figures of these Bogs, at least 4-5ths of their superficial extent is within half an Irish mile of the dry land which forms their respective boundaries, or the islands that they contain.

Planting.

ON this branch of the subject, Mr. Richard Griffith junior observes, that the antiseptic quality, so universally found in Bogs, must effectually prevent the growth of all plants that strike deep in ground, or depend for subsistence on a top root; we must not therefore, he thinks, expect to find the oak thrive upon deep Bogs. He states, that it will be advisable, previously to the planting of any trees upon Bog, to destroy this quality (so inimical to vegetation) either by exposure to the atmosphere, or by the admixture of lime, limestone, gravel, or other calcareous matter, the soil being turned up after drainage (which must be the first step towards every improvement on Bog) for 2 or 3 feet in depth, and exposed to the influence of the atmosphere, then mixed with a portion of limestone gravel, the success of the plantation, he observes, would be scarcely doubtful. The Scotch fir, in his opinion, grows better than any other tree on red Bog; he mentions, that he found growing in one of the wettest quagmires of the Bog of Portarlington, an ancient fir tree of considerable magnitude; the Bog in this place was 19 feet deep, the tree had spread its roots horizontally to a very great distance around, and within the limits of these roots the Bog was perfectly dry, when at a very small distance beyond them it was so wet as to render the walking on it without the assistance of planks nearly impracticable. He states, that larch grows vigorously on shallow black Bog, and entertains no doubt, that larch and every species of fir, as well as birch, alder, and ash, would grow vigorously upon Bog, if the process above recommended were adopted.

Upon the subject of planting on Bog, Mr. Edgeworth observes, that many Bogs, after they have been drained to a certain degree, are capable of being planted, without any further care than to dig up and break the surface round each plant, but that wherever water settles after the trees are planted, it must of course be drawn off. He states, that in the Bog, No. 5, in his district, the growth of the Bog myrtle, and of some trees that had been planted on the border of the Bog, made him point it out in the Appendix, No. 5, as a proper place for an experiment upon planting Bog, without first claying and breaking it up. Among the young trees that he saw thriving on this Bog, he was surprised to find some vigorous larch; he has since seen in Bogs in the Queen's county, other instances of thriving larch. He does not recollect to have seen oak growing on Bog far from its edges; and he has been told by a gentleman of observation, that the roots of no trees can live in the lower part of deep Bogs; his own experience on this subject is but limited. He has seen large and strong Scotch fir in deep Bogs, and some good alder; but he has reason to believe, that common oziers do not grow well in such soil.

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Mr. Longfield observes, that in treating of improvements upon such extensive tracts of plain surface, he conceives it to be of the highest importance to take into consideration the most efficient way of providing shelter; for this purpose, he proposes to intersect the Bogs with belts of skreen planting, in such proportions as local circumstances render necessary, always keeping in view to break the effects of the prevailing westerly winds. The object of shelter would not only thereby be obtained in a few years, but also a profitable growth of timber, which would contribute to repay the expense of draining, &c. The description of trees which Mr. Longfield observed to thrive best on Bogs, are firs, alders, birch, sally; a good specimen of which may be seen at the Earl of Charleville's, Mr. Curtis's, &c.

There are many plantations lately made, particularly on Lord Charleville's part of the Bog, which are in a thriving state, both on the verge and in the deep red Bog near the Glash bridge; this part, which he is certain was not less than from 10 to 15 feet deep, when the improvements were commenced about 18 or 20 years ago, is now covered with trees of different descriptions, chiefly firs, many of which would square from 6 to 9 inches; and his Lordship assured him, that they were planted in the actual red Bog, without any compost or earth balls, which might be presumed necessary for Bog plantations.

He reports another circumstance that may be sufficient to remove any doubt, as to the practicability of covering a great part of these tracts with plantations; he states, that the trees he has just mentioned, planted by Lord Charleville, are actually growing within a few feet of the depth of the ancient timber produced by the same Bog, and which is now several feet under the present surface, the stumps and roots however may be seen in the side of the plantation ditch, and many of them were necessarily cut away and raised, in making the drain on each side of the road, where their roots appear considerably above the under strata, which proves that this ancient timber must have grown on a stratum of Bog, without receiving any nourishment from the clay and gravel.

The only improvements in the way of plantation, mentioned by Mr. Townshend to have been actually effected in his district (except that on the Bog of Bunnahindly, near Athlone, already stated) are the plantations of fir made by Mr. Holmes, of Mount Prospect, on parts of the Bog adjoining his estate; and Mr. Townshend adds, that this gentleman has made drains on the surface of a large tract of Bog, with an intention of planting and improving it.

Mr. Adamson has also planted fir trees, and made surface drains on a part of his Bog near Corr.

Mr. Jones says, that the trees usually planted in such parts of the Bog in his district as have been improved, are, Scotch fir, spruce, larch, alder and birch, all of which seem to thrive well.

We have now only to state the expense at which each Engineer has estimated the execution of the works which he proposes in his district, the costs of a first improvement of the Bogs, and such as will place them in a state of profitable agriculture.

Mr. Richard Griffith junior, calculates the expense of drainage at £.1. 16*s.* per acre; and after entering into detail of the Outlay and Return, from a course of four years progressive improvement and cultivation, he states the ultimate loss thereon at 16*s.* 1*d.* per acre; which, together with £.1. 16*s.* per acre for drainage, amounts to £.2. 12*s.* 1*d.* per acre, being the total expense to be incurred in order to bring red Bog to the value of £.1. 10*s.* per acre per annum.

Mr. Edgeworth calculates the expense of drainage at ten shillings Irish, per Irish acre, which for 21,367 acres, the extent of the Bogs in his district, amounts to £.10,683. 10*s.* Irish; the expense of turning up and burning the surface, and of laying out clay and gravel by means of his portable railways, he estimates at £.8. 5*s.* per acre, including all charges; thus, according to his plan, the total expense for draining and reclaiming Bog, will be £.8. 15*s.* Irish, per Irish acre; and consequently to improve the Bogs of his district, viz. 21,367 Irish acres, would, according to his estimate, cost £.181,619 Irish, equal to £.167,648 English, for 34,569 English acres.

By such improvement, Mr. Edgeworth asserts the land will become worth 30 shillings per acre, giving a permanent income of nearly £.30,000 English for less than six years purchase.

Mr. Longfield reports, that the Bogs in his district amount to 44,591 English acres, the expense of draining which he estimates at £.87,233, being rather less than two pounds per acre. He has not given a specific estimate of the cost of laying out manure or gravel.

Mr. Townshend estimates, that the expense of drainage in his district (the Bogs of which contain 21,298 Irish, or 34,500 English acres, will amount to £.63,435. He has added a further estimate of £.18,530, for masonry in the proposed drains, and of £.8,000 for locks, in case of the construction of navigable canals of large dimensions; but these latter sums for the present, we put out of consideration, having already stated our opinion on the subject of extensive Canals in the Bogs; considering the expense of excavating his drains alone, (which however it must be observed, are of greater dimensions than we think necessary,) the expense per Irish acre for drainage, will be

	£.	*s.*	*d.*
(which however it must be observed, are of greater dimensions than we think necessary,) the expense per Irish acre for drainage, will be - - - -	3	—	2
The expense of gravelling and other charges of reclamation, he states per Irish acre, at - - - - - - - - - - - -	5	11	—
The total expense therefore of reclaiming Bog will be, according to Mr. Townshend's calculation, per Irish acre - - - - - - -	£.8	11	2

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And the total expense of reclaiming the 21,298 Irish acres of Bog in his district, will be £. 182,275. 7. 8. These Bogs he calculates will then be worth 30 shillings per acre, and thus an income of £. 31,947 will be gained at less than six years purchase.

Mr. Jones's district contains 42,370 English acres, the expense of draining which he estimates at £. 75,065, being at the rate of £. 1. 15. 5. per English acre, nearly.

He has not given us any information as to the expense of any further process in the reclamation of Bogs, nor as to the profit which would be derived from it.

The opinion in our former Report, showing how unfounded were the apprehensions of those who conceived that the supply of fuel would be diminished by the drainage of the Bogs, has acquired additional strength as we obtained additional information, and we do not think that there exists the slightest cause for apprehension upon this head; on the contrary, there can be no doubt that the supply of fuel will be thereby considerably increased.

In our first Report we submitted a detailed Statement of our Expenditure in two Accounts, forming the 2d and 3d article of its Appendix; commencing with the 10th September 1809, the day on which we held our first meeting, and ending with the 15th April 1810. As the forms of these Accounts were prescribed by orders of your Honourable House, we have thought it right to adopt them also in the present instance, and we have accordingly carried on these Accounts under the same headings, from the 15th April 1810, to the 5th January 1811, and have subjoined them as the 2d and 3d articles of the Appendix to this Report.

From these and the former Accounts, the nature of our expenditure is shown in the utmost detail. We shall here observe in general, that our total Expenditure during the year, from the 5th January 1810, till the 5th January 1811, may be classed as follows:

	£.	s.	d.
1. Salary of our Secretary and one Clerk, being the entire expense of our Establishment - - -	256	17	6
2. Salary and travelling allowances of (9) Engineers -	4,311	2	9
3. Ditto - - - - - - - - - - of Surveyors -	4,198	7	10¼
4. Pay of staffmen, chainmen, and labourers - -	2,030	2	11½
5. Implements and contingent expenses for Engineers -	85	11	7½
6. Miscellaneous payments - - - - - -	129	17	11
Total - - £.	11,012	—	7½

It must not however be supposed, that the total expenditure has been incurred upon the districts which form the subject of this and of our former Report.

The surveys of three other districts, Mr. Aher's, Mr. Brassington's, and Mr. Colhourne's, are completed; Mr. Longfield has also made considerable progress in his second district; and Mr. Richard Griffith junior has completed the greater part of another very extensive district, being the third which we have committed to his charge.

We think it necessary also to observe, in making any comparison of the work which has been done with the money which has been expended, and in justice to the Gentlemen whom we have employed, that the Engravings annexed to this Report can give no adequate idea of the degree of care and accuracy with which the documents in our possession have been executed. The original maps furnished to us by our Engineers, and which are on a scale which precludes their being engraved, whether considered as works of science or of art, reflect the highest credit on the Gentlemen who have been employed on them; and while they form in themselves most valuable working plans for any operations that may hereafter be undertaken, contain also such accurate delineations of the districts which they embrace, as will furnish the most authentic materials for any future map of Ireland. They are accompanied further with above a thousand miles of sections, drawn on the large working scale, showing not merely the depths of these Bogs, and the nature of the under strata, but marking also the precise height of every spot of their respective surfaces within the lines of section, above a line which we have marked on the mole in the Bay of Dublin, as the ordinary level of high water mark; we believe that there does not exist a similar *map of the levels* of any other country, a work which must be of great importance in determining the lines of any internal navigation which may in future be adopted.

We have found it impossible to complete our survey within the time prescribed for the duration of our commission; we have employed every Engineer we could find in Ireland, who would enter into our engagements, and of whose qualifications we approved. We have endeavoured to procure others from England and Scotland, but without success, upon the present rate of our allowances; a proof, we conceive, at least of the attention to economy with which they were determined on, and in which we should not feel to have been justified, if we had obtained less satisfactory Reports from the Gentlemen who have given us their assistance.

If it should be the wish of the Legislature that this survey should be continued, an additional grant of Money, and an Act of Parliament to extend the duration of our Commission will be necessary. The sum remaining in our hands is £. 2,338. 11. 1. Without a material addition to that sum, the surveys of the Districts beyond the Shannon, now in great forwardness, cannot be completed, and most of the expense already incurred upon them, will

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will have been lost; we are not yet able accurately to estimate either the money or the time which the completion of the Survey of all the Bogs of Ireland would require, but we are inclined to believe, that the labours of another year from the expiration of our Commission, and the expenditure of a further sum of eleven or twelve thousand pounds, although they would certainly not see the task completed, would yet not leave much to be desired.

Dated this
8th day of March 1811.

J. LESLIE FOSTER. (L.S.)
HANS BLACKWOOD. (L.S.)
WILLIAM GORE. (L.S.)
RICHARD GRIFFITH. (L.S.)
HENRY HAMILTON. (L.S.)

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THIRD REPORT ON THE BOGS OF IRELAND:

April 1814.

IN our **First** and **Second** Reports, we submitted to Your Honourable House, the Reports which we had received from our Engineers, on Six large Districts, containing in the whole 233,538 English acres of Bog.

We now proceed, in the execution of our Commission, to lay before Your Honourable House, the Ten following Reports, which we have since received from our Engineers:

	Containing of Bog, English Acres,
(1.)—From Mr. LONGFIELD; on the District of *Lough Gara*, situated in the Counties of Roscommon, Sligo and Mayo,	83,689.
(2.)—From Mr. AHER; on a District lying between *Roscrea* and *Killenaul*, situated in the Counties of Tipperary, Kilkenny and the Queen's County - - - - - - -	36,025.
(3.)—From Mr. AHER; on a District lying to the Westward of *Maryborough*, and situated in the Queen's County - -	14,754.
(4.)—From Mr. COCKBURN; on a District in the Western extremity of the County of *Clare* - - - - - -	22,340.
(5.)—From Mr. BRASSINGTON; on a small District on the Banks of the River *Barrow*, in the Counties of Kildare and the King's County - - - - - - - - -	7,459.
(6.)—From Mr. JONES; on the District of *Lough Corrib*, lying in the Counties of Galway and Mayo - - - - -	83,724.
(7, 8, 9.)—From Mr. BALD; on three large Districts in the County of *Mayo* - - - - - - -	161,962.
(10.)—From Mr. TOWNSHEND; on a great District surrounding *Lough Neagh*, and extending to the Mouth of the River *Bann*, lying in the Counties of Antrim, Down, Armagh, Tyrone and Londonderry - - - - - - - -	64,855;—
Exclusive of 10,673 Acres of Lands, inundated by the Winter level of the Lake.	

The Bogs in these Districts are, internally, of the same composition as those we have already described; and are similarly circumstanced: Externally, they are intersected or bounded by streams, to which their surfaces have ample fall for the purposes of drainage; divided by strips of gravelly soil; surrounded by dry upland; and generally varied with islands; consisting, except in a few instances, of limestone gravel (the substance best adapted to their improvement;) their average depth, and the nature of the under strata, agree with those of other districts.

In our First and Second Reports to Your Honourable House, we have so fully detailed the principles of Drainage and agricultural Reclamation of Peat Soil, collected from the opinions and inquiries of our Engineers, that, to enter again upon the same subject, would only lead us to repeat what has been already stated. Our general Observations, resulting from the whole of the inquiry, will be found in the conclusion of our FOURTH and last Report, which we submit to Your Honourable House at the same time with the present; we shall therefore here confine ourselves to pointing out a few of the more remarkable instances of successful improvement, which has been effected in these Districts.

Mr. *Longfield* gives us the following account of an improvement effected on the estate of Lord Dillon:

"The Bog where these improvements were effected, lies on the south side of the road from Lough Glyn to Castlereagh, and joining the lands of Aughalour, which it must be observed is a hill of the finest limestone in the county, and where the only limestone quarries are to be had in that neighbourhood; it is therefore not surprising to find subterraneous communications

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communications round the verges of those lands, being composed of porous limestone, rock and gravel. At the foot of this hill, Lord Dillon laid out a certain portion of red Bog, in lots for his labourers, which was granted to them rent-free (a well adjudged and great stimulus to improvement) ten or twelve years ago: they commenced by building cabins in the driest part of the Bog next the land, and by cutting away the Bog as fast as their means would admit: During the progress of these operations, it was discovered that the under stratum being about eight or ten feet below the surface, was composed of limestone and gravel of the best description, suited to the purposes of Bog improvement. It was therefore suggested, that pits should be made in the Bog for the purpose of raising this manuring gravel to the surface, which was accordingly adopted; and the system continued with such effect, that they have now completely reclaimed ten or twelve acres, which, from being as bad sponge Bog as any in the country, now produces as good crops of potatoes, oats and hay, as any upland in the neighbourhood. The part thus reclaimed, was originally from four to eight and ten feet deep; the chief of which the improvers cut away for turf before they commenced gravelling the surface, but finding that operation too slow, they are now determined to gravel the natural surface of the Bog after being drained, which some of the most intelligent of them assured me, they had no doubt would succeed."

Mr. Longfield further informs us, that he had the satisfaction to find, that Doctor Richardson's system of Bog improvement, has been long anticipated by almost every poor tenant in the islands of Cloneagh, Cloonagh, &c. &c. belonging to Mr. French; "at the former of which Islands, says Mr. Longfield, I was gratified on viewing a specimen of fiorin grass cultivated on red Bog about twenty feet deep; this piece of Bog, after being drained and levelled, got a sprinkling of gravel, and was sown with cabbage-seed two years ago; last year it was planted with potatoes, which being dug out, was in spring of the present year (1811) laid down with fiorin strings, exactly in the way recommended by Doctor Richardson; the whole piece under the grass contains 33 perches of Bog, which has this year produced no less than *two tons weight* of hay, which, as the common people of the country say, is better for horses than hay and oats; and will fatten a beast much sooner than any other kind of forage which they are in the habit of using in that country. This circumstance (was any additional evidence necessary) at once proves that the red Bogs may all be reduced to tracts of profitable pasture and meadow; and in many cases may be applied to the produce of oats and potatoes, if gravel can be had from the under strata, as at Aughalour."

Mr. Aher informs us, that within these few years, upwards of 200 hundred acres of Bog in different parts of this district have been planted with trees of various ages, from two to ten years, consisting of Scotch fir, spruce fir, larch, oak, ash, alder, birch, beech, hazel and timber sallow; almost all of which appear healthy, and promise to do well. The Scotch fir is the most abundant in proportion. Some of those trees are planted on wet red Bog, twenty feet from the gravel, others on compact black Bog fifteen feet in depth; and some have had a few shovels full of gravel thrown under the roots when planted on the light spungy turf, which evidently answers better than being without it.

Those trees that have been planted on firm black Bog, thrive as well as the same species on upland.

Mr. Lidwell, of Dromard, planted some larch and Scotch fir eleven years ago, and they are now as good as any trees of the same age on the upland in the vicinity; Messrs. Birch of Roscrea, have planted about 70 acres of cut-out Bog and wet red Bog; the former are thriving as well as the generality of plantations on upland; the latter they have only commenced on last season, and the number which have missed are not by any means unusual.

Mr. Aher describes a successful improvement of Bog by Mr. Smith, of Racket Hall. He states, that on the north part of the division near Racket Hall, the process of improvements has been carried on, with great success, on red fibrous as well as black compact Bog, which have produced abundant crops of potatoes, oats and hay; and the Bog which had long lain in a state of sterility, has been increased in value nearly equal to the adjoining upland farms.

J. LESLIE FOSTER. (L. S.)
WILLIAM GORE. (L. S.)
HENRY HAMILTON. (L. S.)
HANS BLACKWOOD. (L. S.)

April 1814.

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FOURTH REPORT ON THE BOGS OF IRELAND:

April 1814.

IN our Three former Reports, we submitted to Your Honourable House, the Reports which we had received from our Engineers, on Seventeen large Districts, containing 731,976 English Acres, of Bog, particularly surveyed.

We now proceed to lay before Your Honourable House, the following Reports which we have since received, and with which we propose to close the execution of the Commission intrusted to us by the Legislature.

		Containing of Bog, English Acres,
(1.)—From Mr. *Nimmo*, on the District of Iveragh, forming the South Western extremity of the County of Kerry - -		43,567
From Mr. *Nimmo*, on the following Districts:		
(2.)—The District of the River Kenmare, in the County of Kerry - - - - - - - -	14,605	
(3.)—Of the Rivers Laune and Lower Maine, in the County of Kerry - - - - - - -	17,990	
(4.)—Of the Upper Maine, in the County of Kerry -	8,566	
(5.)—Of Slieve Luaghar, in the Counties of Kerry and Cork - - - - - - - - -	32,902	
(6.)—Of the River Cashen, in the North of Kerry -	31,514	
		105,577
(7.)—From Mr. *Edgeworth*, on the District of Loughree, situate in the Counties of Longford, Leitrim, and Roscommon -		26,630
(8.)—From Mr. *Griffith*, on the Southern extremity of the District of the River Suck, in the Counties of Galway and Roscommon - - - - - - - - - - -		76,848
(9.)—From Mr. *Griffith*, on the Northern extremity of the same District - - - - - - - -		52,390
TOTAL -		305,012

Exclusive of above 500,000 English acres of Bog, in the counties of Kerry and Cork, which, though generally examined by Mr. Nimmo, have not been made the subject of a specific Report.

From Mr. *Griffith*,—a general Report on the Mountainous District in the counties of Wicklow and Dublin:—A similar Report, from Mr. *Griffith*, on the Mountainous District of Erris, Tyrawley, Burrishoole, and Tyreragh, in the counties of Mayo and Sligo:—And a similar Report, from Mr. *Nimmo*, on the Mountainous District of Cunnemara, in the county of Galway.

IN our former Reports, we have so fully submitted the opinions of Mr. Edgeworth and Mr. Griffith, on the practicability and the profit of reclaiming Bogs, and their view of the best means adapted to its accomplishment, that it cannot be expected their present Reports should furnish much additional matter on the subject; they must rather be considered as applications of their principles to the new districts, conducted with the same accuracy of detail that has distinguished their former labours.

Mr. *Nimmo*, has not however, before, had occasion to furnish us with his ideas on these subjects; and we consider his Reports on the various and extensive districts comprised in these surveys, as highly valuable additions to the information which we have hitherto collected.

The extensive district which has been surveyed in detail, by Mr. Nimmo, embraces nearly the whole of the county of Kerry, and a part of the county of Cork, and contains much variety of surface, and a vast extent of Bog; in many instances, essentially different in its character and circumstances from those which we have hitherto considered.

For the improvement of elevated or mountain Bog, of which a great proportion of this district appears to consist, Mr. Nimmo principally recommends Irrigation; the advantage of which, in reclaiming Bog, he states, has been proved by experience, in some few instances in Ireland, but principally in Scotland, where the Bogs are often found to be circumstanced very similarly to those of Kerry. Mr. Nimmo observes, that wherever a stream flows through Bog, it appears to prevent the growth of the Bog plants, and the vegetation of wholesome grass is rapid on its banks. Whether this effect is produced by a mechanical transport and deposition of the soil, or by the dilution and correction of the astringent principle abounding in Bog, Mr. Nimmo does not decide; but he proposes irrigation accompanied

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panied by shallow drainage, such as will carry off the stagnant surface water, as peculiarly applicable to the mountain Bogs of Iveragh and Dunkerrin district. From his calculations, which are ingenious, it appears, that one-tenth of the Bogs may be irrigated at one time, by a judicious distribution of the mountain water. His plans will be found detailed in his Report; and he estimates the expense of this operation at only one guinea per acre. Bog thus improved, he says, will produce green crops in abundance, of no small importance in a country like Iveragh, where cattle are bred in great numbers, and where butter is the principal article sold for the farmer's profit. The general principle of this mode of improvement, he states to be as follows:—

"The catch-water drain is to be first formed on the edge of what in Scotland is called bent moss, or on the boundary between the Bog and Mountain; this will answer at the same time as a head fence; the Bog is next to be marked off in ridges, at distances of one perch asunder, and a small furrow taken out with the spade one foot wide and ten inches deep; the spade used for this should be a foot wide, with a small feather, which will save time in casting; if the Bog be pretty flat, the whole declivity will be wanted in the furrow, which must therefore be drawn in the direction of the fall, and a small water furrow of moderate depth drawn here and there obliquely across the ridge; if the Bog be not flat, the original furrows may be made obliquely down the declivity, and will of themselves act as water furrows. The Bog must now be left some time to get relieved of the surface water. In the next place, a small path is to be formed, by carrying gravel and earth out on the middle of every third ridge, so that two ridges may be left in the original state, between every two other ridges which have a path in them. The width of the path may be three feet at first, and will be at least six inches deep of stuff, as the turf from the furrow on each side is cast into the middle of that ridge. The most convenient way of forming this road will be, by the wheelbarrow and planks; if that is not to be had, a hand barrow must be employed.

"This path is intended for horses with panniers, by which it might be extended afterwards to six feet wide; and at least it may be proper to make some turning places on it of that width."

In the next place, he proposes that the Bog should be dug up and carefully formed into ridges, which however must not be so high as to render the middle liable to injury by drought. The higher parts of the Bog are to be levelled down into the hollows, the surface of the ridge is to be pulverized with the spade, hoe or otherwise; and as it gets dry, he proposes that the ridges which have the path in the middle, should be harrowed by horses, with the help of a splinter-bar somewhat longer than common. A top dressing of such manures as are suggested by Mr. Nimmo, is then to be applied, which may be carried on the Bog by means of horses and panniers; the Bog is to be left for one year, to consolidate in the interior and pulverize on the surface, that part which is intended for pasture being sown with grass seeds.

But the tenant, Mr. Nimmo observes, will naturally look for some crop, the very first year after performing this labour; and where a dressing of shell, sand, or other calcareous matter has been applied, the ground may be sown with oats, and a tolerable crop may be relied on. But potatoes are more likely in this country to repay the cultivation; a crop therefore of these may be taken in the usual way, that is, by forming beds across the intended ridges, earthing over the plants with the stuff taken from the trenches; manure however or earth in this case will become necessary; the manure may be greatly increased in quantity by intermixture a few weeks before-hand with the turf or other vegetable matter. Next year the beds may be formed into ridges by filling up the intermediate trenches, a top dressing of sand applied, the Bog sown with oats or wheat, and harrowed in by horses or by men.

The third year of cropping may be oats or barley, with perennial grass seeds, which being cut for hay next year will leave the ground a tolerable meadow.

The expense of this improvement Mr. Nimmo estimates at £. 9. 14. 2. per acre; and the potatoe crop he values at £. 10. 8. giving a profit of 13*s.* 10*d.* per acre, over and above the total expense of the improvement, and leaving the Bog in a state that will produce a considerable annual rent, in many instances of at least £. 3. per English acre. Mr. Nimmo has given other rotations of crops applicable to the reclamation of Bog in mountainous districts; and he shows, by an ingenious calculation, that in Iveragh (where the expense of a horse per diem does not exceed the wages of a labourer) two labourers and one horse can improve five acres of Bog in one year, and derive an adequate maintenance from the produce. It appears, that in this mountainous tract there is hardly any limestone; shell, sand, and sea weed are used as manures.

Thus far with respect to Bogs in mountainous countries, where the extremities of the Bogs being on higher levels than the interior, usually present great facilities for irrigating the interior: but in flat countries the case is widely different; in these the surface of the Bog is almost always more or less convex, and this circumstance, except in very particular situations, will generally preclude the adopting of this powerful means of amelioration. These bogs, in flat countries, are also of a depth vastly greater than in mountain districts; such, says Mr. Nimmo, require more capital for their improvement; nevertheless his calculations deduce that Bogs of this nature, such as are common in the flatter parts of his district, may be improved at an expense per acre not exceeding the value of the first crop obtained, and that the land so improved, will afterwards afford a permanent rent of one-seventh of this amount.

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Mr. Nimmo adduces a practical instance of successful reclamation, in the wild country which forms the subject of his Report.

He informs us, that a Mr. Murphy has taken a lease of fourteen hundred acres of Bog, and of the adjacent Mountain, from Judge Day, and has already built a number of cottages on it. He limes at the rate of one hundred barrels, which cost 33*s.* 4*d.* but which, with carriage, breaking and burning, comes to about £. 7. 10*s.* per acre; then having drained and dug the field, which is not done under 50*s.* more, he takes one crop of potatoes, about three Kerry barrels of 21 pecks; taking these at 4*s.* per peck, the produce of the first

crop - - - - - - - - - -	is -	£. 12 12 —
Next crop, better, - - - - -	say -	16 — —
Third crop, worse, - - - - -	say -	12 — —
A crop of oats, - - - - - -	worth	10 — —

When he leaves it for meadow, and it pays in that state a rent of £. 4, or four guineas per acre. He finds the potatoes raised from Bog, and those from earth, much of the same quality; the first are not so dry, but larger and more productive.

With respect to Drainage, Mr. Nimmo's opinion is, that surface draining is alone adapted to the reclamation of Bog: He proposes catchwater drains to intercept the waters from the higher grounds, and then a system of shallow drains to deliver the surface water of the Bog into the natural streams, and so contrived as to further, if need be, the business of irrigation. These drains will of course vary in dimensions and number, according to the wetness of the Bog; but he thinks that in no case ought they to exceed six feet in depth: The drainage, Mr. Nimmo states, may in general be effected at the rate of 12*s.* 3*d.* only, per English acre.

When the Bog has been drained, it is to be consolidated by an admixture of soil; this, he tells us, may be effected in various ways:—1st, By laying out soil as a top dressing: But this is the most expensive mode of improvement; the cheapest rate at which it can be executed being £. 5. 9*s.* per acre, and the expense in some cases amounting to three times that sum.– 2dly, by Irrigation; which uniformly appears to convert the surface into soil— 3dly, by Liming and repeated Ploughings; which, in process of time, Mr. Nimmo assures us, will convert the surface into vegetable mould.—For the details of these operations we must refer to Mr. Nimmo's Report.

Mr. *Richard Griffith*, in his Report on the district of the river Suck, furnishes to us valuable instances of considerable Bogs which have been actually reclaimed, and which continue to afford a large profit to the reclaimers. After these, he observes that the Bog improvements at Woodlawn are amongst the most perfect: They amount altogether to about 292 English acres; 25 acres of which are under plantations, now growing with great vigour. These improvements were commenced about the year 1760, by the late Mr. Freach of Woodlawn, and have been continued by his son Lord Ashtown. Mr. Griffith observes, that they effectually contradict an assertion frequently made, that Bog, however reclaimed, will again return to its original state, if left undisturbed for a few years.

For the detailed account of these improvements, so encouraging to reclaimers, we must refer to Mr. Griffith's Report.

The soil of these reclaimed Bogs, when first turned up, is, as Mr. Griffith observes, of a dark brownish colour; its specific gravity, when compared with earthy soils, is certainly light, but it is much heavier than common Bog stuff; the whole of the vegetable fibres have disappeared at the surface, however, at three feet deep, the mossy structure is still visible.

The plantations of trees upon the Bogs at Woodlawn, are all in a very flourishing state; some of which, he observes, have now been planted 55 years.

It is with pleasure that we note this circumstance; for there are few prejudices more inveterate on this subject than a persuasion, that it is in vain to plant upon a Bog.

In this plantation the ash appear to be the best; the roots of the trees growing on the Bog have not shot down, but have grown quite on the surface; some of them, particularly the ash, have formed a hillock of roots above the general surface of the Bog; the top of the hillock is covered with soil, but at the sides the roots appear uncovered; they differ from common roots, as they are coated with a strong bark similar to that which covers the stem of the tree.

Mr. Griffith informs us, that the improvements on Bog made by the Bishop of Clonfert, though not very extensive, deserve attention, from the very uninviting prospect which they held out previous to their drainage. The Bog of Clonfert, of which they form a part, is very wet, and is deeper and more extensive than any in that part of the country, and upon the whole exhibits a most unpromising appearance to the reclaimer of Bog; the Bishop of Clonfert has nevertheless effected a valuable improvement by the common method of draining and manuring with limestone, gravel, or white shell marle, of which there are inexhaustible quantities along the banks of the Shannon. The crops which Mr. Griffith saw on the Bog at Clonfert were wheat, oats and hay. The produce of the wheat crop was considerable, but the grain small and not well coloured; the oats and meadow were both very good. The Bog fields are for the most part surrounded by double ditches; and here again we find an instance of successful plantations; they have been made without any manure in the spaces between the fields; the trees, says Mr. Griffith, are in a thriving state, particularly the Scotch fir, birch and poplar.

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Mr. Griffith adduces another instance of successful improvement effected by Mr. Hodson; and after detailing the particular mode by which it has been accomplished, observes, That it thus appears, that Mr. Hodson has a return of £. 5. 9 *s.* per acre per annum profit on his reclaimed Bog, for four years; and further, that the Bog is, at the end of that period, of such value, as to let as meadow ground for three years, at the rate of £. 5 per acre per annum, or if let on lease of 21 years, at £. 1. 10*s.* per acre.

Mr. *Edgeworth* and Mr. *Griffith*, in the Appendixes to their respective Reports, have furnished to us a narrative of the practical success of the experiment of Reclamation, conducted on a very considerable scale, at Chat Moss in Lancashire, visited by them.

"This Moss," says Mr. Edgeworth, "which is of considerable extent, is in every respect similar to most of the Bogs which I have surveyed for the Board; its vegetation, depth, consistency and levels, resemble an Irish Bog so nearly, that no sensible difference can be discerned. Mr. Roscoe has divided a great portion of this moss into compartments, by parallel drains of four or five feet wide, and as many feet deep; these drains are in general about sixty yards asunder; smaller water tables are cut in proper places to carry off the surface water; the moss is then covered with four hundred loads to an acre of clayey marle; this covering is laid on by means of short light iron railways, which can be removed from place to place; these railways rest upon short joists of cheap wood, eight or nine inches broad, and upon the railways are small carriages mounted on cast-iron wheels, which are from one to two feet diameter; these carriages are pushed forward by men; and when the soil has acquired by this means some consistency, horses furnished with wooden clogs twelve inches square, which they soon learn to manage with facility, are employed to plough and harrow with very light ploughs and harrows. The loose surface of the Bog is easily tilled, and various crops are obtained by sowing and dibbling in the usual manner. In many instances, the first crop has paid the immediate expense of cultivation; by immediate, I mean the labour and seed, exclusive of the prime cost of the apparatus and of its repairs.

"I happened to visit Mr. Roscoe on the day after his having sold, for ten thousand pounds, one thousand acres of that part of Chat Moss which he had improved, and which he held for a lease of ninety-nine years."

This successful experiment must make a greater impression on the public mind, than all that can be theoretically advanced; "and it may be reasonably hoped," says Mr. Edgeworth, "that it will induce some similar attempt upon a large scale to improve Bog in Ireland."

Mr. Griffith's statements on this subject so nearly agree with Mr. Edgeworth, that we feel it unnecessary to quote them.

After the numerous Surveys (conducted under our direction) of the flat Bogs lying intermixed with the arable and cultivated lands, in some of the richest and most populous districts of Ireland, we have thought it right to procure a general examination of the most remarkable Mountain Districts which are covered with Boggy surface, but which, in their present state of desolation and abandonment, did not appear to us to justify the expenses of a particular survey.—In these we have confined our Engineers to more general Reports, accompanied with such MAPS as our Engineers could furnish, from the best materials already in existence, corrected by their own general surveys.

For this purpose, we committed to the care of Mr. *Richard Griffith*, the district of Mountains lying within a few miles of the Metropolis, and occupying a large portion of the counties of Dublin and Wicklow.

We further gave in charge to Mr. Griffith, the wild regions which occupy the north-west of Mayo, and the north of Sligo, known under the denominations of Erris, Tyrawley, Burrishoole, and Tyreragh.

And we intrusted to Mr. *Nimmo*, the extensive and desert districts of Cunnemara, occupying the west of the county of Galway.

It appears from Mr. R. Griffith's Report, that the Bogs which lie interspersed amongst the Mountains in the first-named district, exclusive of the general covering of the high mountains, may be estimated at about 97,000 English acres; and he gives the fairest grounds for hoping, that not only they, but a considerable portion of the mountain soil, may be improved at a small expense, so far as to afford excellent pasture and meadow.

Mr. Griffith observes, that these Mountains differ, in climate and local circumstances, from all other uncultivated districts with which he is acquainted. These peculiarities are described at length in the progress of his Report; they consist chiefly in the facility of access to the uncultivated parts, by means of roads, the vicinity of highly improved lands, and industrious inhabitants; the frequent occurrence of beds of limestone, gravel and marle, affording the best manure for the amelioration of mountain soils; and lastly, the uncommon mildness of the climate.

Mr. Griffith seems very much to agree with Mr. Nimmo, as to the utility of irrigation in the improvement of mountain Bogs. On the precipitous sides of mountains, where ploughing would be difficult, he recommends, that intercepting drains be cut nearly on a level along the face of the declivity, to catch the water which may fall from the summit; and he is of opinion, that these drains will be found sufficient without others, and to render the surface comparatively fertile.

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Mr. Griffith observes, that near the barrack of Glencree, he had an opportunity of observing the beneficial effects of an intercepting drain. About two years ago, a turf hole was cut on the declivity of a boggy hill, which had a scanty coat of grass vegetating on its surface; the turf hole immediately filled with water, which flowed from the wet bog above it; to avoid this inconvenience, a small drain was cut to intercept the water from the upper part of the hill one foot in depth, and was carried on nearly in a horizontal direction, fifty yards on either side of the turf hole, and six feet above it: Mr. Griffith saw the place in very wet weather, a year after the drain had been made; above it, the surface was wet and soft, and the grass scanty and very unhealthy in its appearance; below it, the surface was perfectly firm, and was covered with luxuriant grass. The beneficial effects of this small drain were visible for more than fifty yards downwards.

We believe that many unsuccessful attempts to drain Bog have proceeded nearly on an inversion of this principle, expecting that the drain should operate principally upon the Bog on the higher level. We believe, however, that in all instances of bog improvements, the effect really produced will be found rather to agree with the instance adduced by Mr. Griffith.

Mr. Griffith has given a Sketch of the mineralogical and geological features of this district; which is interesting in many points of view, and as connected with agricultural improvement, of considerable importance. In mountain districts, above all others, the quality of the soil depends upon the nature of the rock; and as the various soils to be found in such situations frequently act as manures on each other, a knowledge of their component parts must be useful to the mountain farmer. The tract of mountain which Mr. Griffith describes, is composed partly of granite, partly of slate, and other stratified formations. In the vallies are found limestone, gravel, and not unfrequently calcareous clay marle.

It appears that, in the administration of the Earl of Hardwicke, steps were taken towards establishing, in these mountains, a Settlement composed of the disbanded soldiers of every Highland fencible regiments. Circumstances occurred to prevent the completion of the plan; but it may not be unworthy of the attention of Government, should the return of peace afford an opportunity for carrying measures of this sort into effect.

Mr. Griffith, in his report on the Mountain district of Erris and Tyrawley, informs us, that this dreary country is essentially different from any thing that we had before committed to his charge; the surface wild and rugged; and in most places the hills and the plains, the summits of the mountains, and the valleys covered with a shallow stratum of black Bog.

The mountainous districts of Erris and Tyrawley, exclusive of Tyreragh in the county of Sligo, containing altogether about 477,850 English acres, of which about 152,260 English acres are either in a state of cultivation, or covered with sand; 155,500 English acres are nearly unproductive mountain, and 170,090 English acres are unprofitable red Bog. Instances are not however wanting in this country, to prove what may be done by perseverance and judicious encouragement from the landlord to his tenants. Forty years ago, says Mr. Griffith, the mountains in the neighbourhood of Westport were in a state very similar to that which the mountains of Tyrawley and Erris now exhibit; many thousand acres of these once dreary wastes are now in a comparatively high state of cultivation, owing to the prudent and liberal arrangements made by the late Marquis of Sligo, who gave the people long leases at low rents, finding them disposed to give their labour towards the reclamation of waste lands, provided that they and their children might be allowed to enjoy the fruits of their industry. The system of improvement usually adopted in the mountains of Westport was, first to cut off the water from the mountain above, next to plough up and burn the surface, and afterwards to lime it. The whole of the lime that has been laid out on the face of those mountains, was carried in panniers on horses backs from the sea-shore at Westport, which is the only place in the country where it can be procured.

The Westport mountains, like those of Erris, are chiefly composed of mica slate, and the effect which a small portion of lime has in fertilizing a soil arising from the decomposition of such rocks, is almost miraculous. The fertilizing effects of lime on this soil were first brought into notice in the neighbourhood of Westport, by the late Marquis of Sligo, through whose example and arrangements, as already mentioned, the whole face of the country has been changed, and under whose encouragement the once paltry fishing village of Westport has now become one of the handsomest and best built towns on the west coast of Ireland. Mr. Griffith observes, that he has been credibly informed, that eighty years ago there was but one small field of eight acres of green ground between Castlebar and the sea coast, and this was round Westport house; and within 40 years the roads to the west did not pass Castlebar. At present a Mail Coach comes into and leaves Westport every day; and within the period of 40 years, the town has increased in population from about 200 persons to two thousand five hundred, and the houses have been changed from a dozen dirty fishermens huts, to streets built with unusual regularity.

Mr. Griffith justly observes, that the formation of good Roads, is the first object to be attended to in the improvement of such a country; without them no inducement is held out to the industrious man to cultivate more land than is absolutely necessary for his own immediate subsistence, as he possesses no means of bringing his produce to market; and throughout the great district now under consideration, roads seem hardly to exist. Mr. Griffith brings the fact under observation, that the want of roads in this country limits the production of corn to what can be consumed in illicit distillation, which is now carried on there to a considerable extent. The spirit so manufactured is taken out of the country

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country on horses backs, over moors and mountains, upon which even men find it difficult to walk; and he observes, that if this illicit distillation were now stopped, the growth of corn in the country would be put an end to, as the inhabitants have no possible means of taking their produce to market.

With respect to drainage, Mr. Griffith is very decided in his opinion as to the improvement of those mountains, by the formation of intercepting drains, to serve as irrigators. A single intercepting drain, he observes, judiciously laid out on the sides of many of these mountains, would have the effect of laying dry, hundreds of acres below them, which are at present (owing to springs issuing from fissures on the sides of the mountains) so wet and swampy, that no beast dare venture to walk on the surface. When the intercepting drain had rendered the mountain sides sufficiently dry, they might be converted into flooding courses to irrigate the land beneath; and these flooding courses might be supplied with water by the construction of rough weirs in any of the neighbouring mountain streams, so as to divert the water from its natural course into the intercepting drain, then to be used as a flooder or irrigator.

If this very simple species of improvement were skilfully carried into execution, in all the favourable situations throughout this mountainous district, Mr. Griffith has no doubt that nearly one hundred thousand acres of land would be rescued from their present swampy and nearly unproductive state, and would become of great value, as rearing-ground for young cattle. He adds, that some of these hills might be rendered very productive at a trifling expense; but particularly Ballycollen, Ballyknock, Mama, Choy, &c.; they all contain limestone; and the water of the streams is so highly impregnated with lime, that great quantities of calcareous depositions are found in the eddies of all the streams: Here, Irrigation might be practised with wonderful effect; and he has no doubt that excellent crops of oats, barley and rye, might be raised in all the vallies; the land is probably equal to the production of any sort of grain, but the climate seems to be too damp to bring wheat to perfection.

From Mr. *Nimmo's* general Report on the district of Cunnemara, it appears that this great tract of country contains about 560,000 English, or 350,000 Irish acres: Of this, he estimates,

Arable - - - - - - - - -	25,000
Bog - - - - - - - - -	120,000
Mountain and upland pasture - - - -	200,000
Rock, much of it limestone - - - -	5,000
	350,000

Few tracts in Ireland are less productive than Cunnemara in its present state; yet few, in Mr. Nimmo's opinion, present greater facilities for improvement.

The population he states to amount, at present, to about 30,000; of which one-half is in Cunnemara proper; two-thirds of the remainder in Jar Connaught: Of the Cunnemara population, more than nine-tenths are settled along the sea-shore: The inhabitants of the interior do not amount to 300 families, and those are to be found chiefly along some of the bridleroads that have been made through the country. In Jar Connaught, the population is either on the sea-coast, or on the northern slope of the hills next the limestone country. In Joyce's country, the upland parts are uninhabited. The rental of the whole district he states to be about £. 50,000 per annum; of which the kelp may produce £. 6,000. Various great inlets of the sea penetrate the district, so that no part of it is distant four miles from existing navigation: There are upwards of twenty safe and capacious harbours fit for vessels of any burden; about 25 navigable lakes in the interior, of a mile or more in length, besides hundreds of smaller dimensions: The sea-coast and all those lakes abound with fish. The district with its islands possess no less than 400 miles of sea-shore; on Lough Corrib it has about 50 miles of shore; so that with Lough Mask, &c. there are perhaps as many miles of shore of the sea, or navigable lakes, as there are square miles of surface. There are extensive banks of calcareous sand round the coast in almost every bay; and in the interior there are numerous beds of limestone, nearly all the navigable lakes having some on their banks. The supply of fuel is evidently inexhaustible. There are banks of shell and coral sand on all the coast, but especially in the bays of Kilkerran, Birterhuy, Bunown, Mannin, &c.; this sand is raised by dredging, and by beaching the boat on it at low water. That of Kilkerran, Birterbuy and Mannin, is pure coraline.

On the whole, says Mr. Nimmo, it appears to me that the improvement of this district, so far from being difficult or hopeless, is a thing highly feasible, and if vigorously but steadily pursued, is likely to meet with fewer obstructions and greater ultimate success than perhaps in any other part of Ireland.

The great supply of manure on the coast is the red sea weed, which is cast ashore in considerable abundance, and frequently cut in the deep water by people in boats. Two or three boat loads of about six tons each, are usually applied as manure over an acre of potatoe ground: The usual course being,—1st, Sea weed for potatoes;—2d, Oats or barley;—3d, Natural meadow for four or five years, and then sea weed, &c. as before. The grass is mostly fiorin.

On the second breaking up, the surface is frequently pared and burnt. This, in a district where most of the soil is only a thin red Bog upon bare granite, cannot but be very destructive; it has produced much naked rock among the cultivated parts.

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The value of the sea manure is abundantly shown by the numerous patches of cultivated ground which occupy the shore from Galway westward, and where the soil must originally have been of the most uninviting description, being nothing but Bog and rock; a vast extent of it is now reclaimed, and seems fitted for crops of any description; even wheat has been tried with success. It is commonly supposed that grain is apt to run to straw without filling the ear, on reclaimed Bogs. This, says Mr. Nimmo, must arise from the want of manure, or improper drainage, as I have seen on various parts of these shores as good barley as on any dry land in the kingdom; and it must be observed, that it is not the defect, but the excess of drainage which is thus injurious; for as Bog parts with its moisture by evaporation more speedily than almost any other soil, unless a proper supply be preserved in the sub-soil towards the latter end of summer, the crop runs the risk of perishing from drought. In this quarter the perpetual moisture of the Atlantic renders such an accident less probable.

The kelp in 1808, sold in Galway at £.13 per ton; freight thither from the bays, 5s. per ton. At present the price is so low as from £.3. 10s. to £.4; so that many of the farmers find it more for their interest to employ the sea weed in agriculture. This disposition, Mr. Nimmo states, is likely to become general in the present state of the markets, and he thinks it deserving of encouragement. The benefit that would accrue to Cunnemara, from the transfer of the manure and labour to the improvement of the land, is perhaps, he says, not rated too high, when we say it would be annually as much as the present rental.

Cunnemara, like every other part of Ireland, furnishes practical illustrations of the advantages to be derived from the reclaiming of Bog land. We learn from Mr. Nimmo, that Mr. O'Flaherty reclaimed a large tract of Bog at Renville, &c. to the extent perhaps of one thousand acres. He removed the cottagers from their old stations and settled them on the Bog; this they reclaimed with potatoes and sea weed, treating it afterwards with the sand of the shore, which contains no calcareous matter; the effect has been very great. Cunnemara is very destitute of wood, a few scrubby patches only being thinly scattered through it; the country, however, says Mr. Nimmo, possesses an extensive stool of timber, for in almost every knole or clift, the oak, birch and hazel appear shooting in abundance, and require only a little care to rise into valuable forests. Several iron furnaces which were erected about a century ago, consumed much of the timber, and copsing was afterwards unfortunately neglected. The sheltered vales, navigations and abundant command of water, would afford great advantages in the cultivation of timber. Independent of the extensive stool yet existing, the lakes, rocky ridges, and Bogs, afford great facility for enclosing new plantations, and the means of transport are every where at hand; there is already a good deal of brushwood among them, but valuable coppices and even timber might be raised, since the roots, ramifying through the numerous fissures of the rock, will find nourishment and a fertile soil, which nothing else could beneficially occupy. Mr. Nimmo truly observes, that planting seems the best system for all extensive moors which are far from manure or limestone; it may be thought, he adds, that the western parts of Cunnemara are too much exposed for timber, but independent of the proof to the contrary, which the ancient Bog wood affords, we have timber now living and thriving in these situations; Mr. John D'Arcy, of Killalla, has succeeded well in raising most kinds of timber at Clifton on Ardbear Bay, though immediately exposed to the Atlantic; his nursery there is in good order, and he is extending the plantations. The copses of Ballinaboy, Munga, &c. are also very near the ocean; and the wood of Clonile in Birterbny Bay, grows down to the water edge.

The survey of Cunnemara confirms Mr. Nimmo in the decided opinion which his experience in other districts had led him to express, as to the perfect practicability of Bog improvement. "I am perfectly convinced," says he, "in the conclusion of his Report, from all that I have seen, that any species of Bog is by tillage and manure capable of being converted into a soil fit for the support of plants of every description, and with due management, perhaps the most fertile that can be submitted to the operations of the farmer: green crops, such as rape, cabbages, and turnips, may be raised with the greatest success on firm Bog, with no other manure than the ashes of the same soil; permanent meadows may be formed on Bog, more productive than on any other soil; timber may be raised, especially firs, larch, spruce, and all the aquatics, on the deep bog, and the plantations are fenced at little expense; and with a due application of manure, every description of white crops may be raised upon Bog, and I know no soil from which they can be extracted without it."

In conclusion of our inquiries, it may naturally be expected that we should express our opinion whether any, and what general measure should be adopted, to further the reclamation of this great extent of land, at present so unprofitable, and which the concurrent testimony of every person, except one, whom we have employed, represents as not merely susceptible of improvement, but as promising to afford a greater profit on the operation than perhaps any other application of agricultural skill and capital.

Various as are the modes of improvement, and the estimate proposed by our different Engineers, we consider that the fair average of their opinions, represent that by an expenditure of from £.1 to £.20 per acre, the reclamation would secure to the improver a permanent rent of from 10 to 15 per cent. on the expenditure. Some of them, on whose judgment we place great reliance, are even of opinion that the whole of the capital employed would be returned by the produce of the first crops which effected the improvement. Supposing then the capital employed to be finally lost, still the rent obtained would abundantly compensate for its application; but on the other supposition of the capital itself being repaid, it would

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follow that the rent would finally become the reward merely of the skill and labour of the improver.

Nor is it on mere theoretical speculation that these premises are rested. Our engineers uniformly adduce the example of hundreds of acres actually improved within their respective districts, to justify their estimates.

It may, perhaps, then be inquired, why all these Bogs have not long since been improved? or it may be asserted, that their present desolation in the midst of so much apparent inducement, is in itself a sufficient proof that such premises must be practically fallacious.

We are convinced, however, that this circumstance may be otherwise accounted for, and that it is not to physical obstacles that the present situation of these wastes is principally to be ascribed.

The arable lands around the extremities of each Bog belong, pretty generally, to a great variety of proprietors; the mearings of whose estates, it is generally admitted, must be contained within the area of the interior Bog, but the precise situation of which is seldom ascertained. The external boundary of the Bog forms a turf bank; the interior is a quagmire, in its present state inapplicable to any other purpose than the affording a very scanty summer pasture to a few wandering cattle, who are turned in to seek for it, at the risk often of being lost. The cultivators who occupy the contiguous farms, have usually annexed to the enjoyment of the lands, a right of turning in their cattle on the part of the Bog adjoining to their respective farms; and when these are tempted by hunger to wander further, reciprocal convenience forbids its being considered as a trespass. These farmers have usually terms of lives or years in their holdings, too short to tempt them, even if possessed of capital and skill, to enter on the permanent improvement of the Bog, while they are yet abundantly sufficient to render such an operation impracticable for the landlord. The landlord has demised to the tenant a vague possession of what he considered of little or no value; the shortness of the tenure obliges the tenant to leave his holding in its unprofitable state; but were the landlord to propose to improve it, the tenant having a present right to prevent him, that right would become valuable just in proportion to the intended exertions of the landlord, and would inevitably be set up by the tenant.

Mr. Edgeworth, in his Report, adduces a very practical instance of the operation of these obstacles. He mentions, that he should himself have made an attempt to improve Bog, could he have obtained in his neighbourhood a large tract of the Bogs which he had surveyed near the Inny, in district No. 7; but the uncertainty of their respective properties, says he, deters the owners of these Bogs from entering into engagements for their improvement. The reasonable dread of litigation prevents proprietors from seeking, through their own exertions, those advantages which they hope to derive from the adventurous spirit of others; it cannot be expected that this obstacle to the improvement of the Irish Bogs, can be removed by any thing short of legislative interposition. It is within the knowledge of a Member of this Board, that Mr. Edgeworth offered to one of those proprietors, a rent hitherto unheard of for Bog land, proposing only a sixty years lease for his own interest; and the proprietor professed himself perfectly satisfied, on the single but impossible condition, of Mr. Edgeworth undertaking to indemnify him against all the law-suits, which it was well foreseen would be the inevitable consequence.

Having thus pointed out what we conceive distinctly to be the main obstacle to the improvement of the Bogs of Ireland, namely, the uncertainty of the boundaries of estates when they pass through extensive Bogs, and the right usually vested in the occupiers of the adjoining farms, we feel it to be rather the province of the Legislature than of our Board, to devise the provisions which can alone remove this impediment.

To facilitate the speeding of Commissions of Perambulation, which might ascertain the boundaries of contiguous estates, would probably be a measure of no difficult accomplishment; but it would require more consideration to ascertain on what terms the landlord could be permitted to resume from his tenant a vested right, however unprofitable its possession.

Should these obstacles be removed, it would further become necessary to enable the proprietors of estates under settlement, to make long leases of Bog lands for the purpose of improvement; the remainder man would be benefited and not injured by such an interference; his property would ultimately receive a prodigious increase of value, and during the term of years it would at least produce to him a reasonable rent; in its present state it produces almost nothing. The Irish Legislature has already in some degree recognized the principle we recommend, for while it has carefully disabled Bishops and ecclesiastical persons from demising the estates of their benefices generally, for a longer term than 21 years, it has by the statute of 12 Geo. I, cap. 12, specifically excepted Bogs and extensive marshes, and enabled them to demise such for terms of sixty years.

It is also obvious, that in the event of future enterprizes, either by individuals or by associated companies, for the drainage and improvement of large tracts of Bog, it will be expedient that the Legislature should secure by enactment, a free passage under proper regulations, through the adjacent estate, so far as may be requisite for carrying on and completing the main lines of drainage and communication; as otherwise the interested opposition of a neighbouring proprietor might impede and render of no effect the efforts of the improver. Each case, however, will require its peculiar remedy, and we therefore can only advert thus generally to the subject.

Should the Legislature not consider its interference as advisable, one good at least may be expected to follow from these facts being submitted for consideration; that landlords may become more cautious how they enter for the future into such engagements.

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Our Engineers, under the strong impressions of the practicability and profit of these improvements, are naturally anxious to see them immediately undertaken. Mr. Edgeworth submits, that some public experiment should be tried, that might demonstrate to the nation, either that the scheme of improving the Bogs of Ireland is practicable or hopeless; and he expresses his opinion, that nothing but such a plain and indisputable proof of the practicability and profit of reclaiming Bog, is wanting to turn the attention of individuals and of large companies to this mode of enhancing private fortunes, and of increasing national wealth. Mr. Nimmo expresses himself thus on the same subject,—"Upon the whole, I am so perfectly convinced of the practicability of converting the whole of the Bogs I have surveyed, into arable land, and that at an expense which need hardly ever exceed the gross value of one year's crop produced from them, that I declare myself willing, for a reasonable consideration, to undertake the drainage of any given piece of considerable extent, and the formation of its roads, for the sum of one guinea per acre, which is little more than seven years purchase of the rent it would then afford."

An absent Member of our Board, under the influence of similar conviction, has expressed to us his strong desire, that in this our final Report, we should recommend to the Legislature the establishment of a new Board, with the necessary funds and powers for making an experiment, upon a grand scale, in the reclamation of some large Bog in the vicinity of the Capital; and further, to enable them to lend money to persons willing to undertake the improvement of their Bogs, upon receiving proper security for the repayment of the principal by instalments without interest; a principle which has already received the sanction of the Legislature, for the erection of Churches and Glebe Houses, for the formation of Roads in the Highlands, and for the improving the great lines of Mail Road communications in this country. But however specious such a plan may appear, when stated generally; yet, on the contemplation of the difficulties connected with its practical detail, we cannot bring ourselves to agree with his proposal as thus stated. The expenses of the preliminary experiment, if conducted by such a Board, might, we apprehend, afford an example highly discouraging, and no less fallacious, if considered as a measure of the necessary expenses attendant on such a plan when superintended by the vigilance of private adventure.

And if the establishment of a Board, for the sole purpose of forwarding, by loans of the public money, the general drainage of the Bogs (thus supplying the defect of private capital, which is so much to be lamented in this part of the United Kingdom,) should be deemed worthy the attention of the Legislature, it must not be forgotten, that great difficulties would present themselves in selecting, amongst the numerous applications preferred to the Board for the loan of money repayable without interest, the proper instances in which to accept them; that the task of ascertaining that the money when lent was really applied to the professed object, would be no less embarrassing; and that finally, the Board might become involved in endless law suits, in endeavouring to enforce the recovery of the sums advanced, where the adventurers had happened to be unsuccessful.

Influenced by these considerations, we are disposed to confine our recommendations to the legislative removal of those peculiar obstacles to the improvement of these great wastes, already pointed out by us; and we feel a confident assurance, that when peace shall have established the opinion of our British fellow-subjects, with respect to the security of property in this part of the United Kingdom, so obvious a field for the employment of British capital as has been pointed out in these Reports, cannot be overlooked. Nor is it to be objected, that the improvement of such extensive tracts would require a capital of enormous magnitude to effect it; if there is any truth in the opinions which have been so generally advanced to us by those engineers, in whom we place our chief confidence, the very process of reclamation would reproduce to the farmer, in the first crops, the money which he had expended, and which would thus successively become re-applicable to new operations.

HAVING now submitted to Your Honourable House, all the Reports which we have received from our Engineers, we think it may be advisable here, briefly to recapitulate the extent and application of their numerous inquiries.

	Containing, of Bog, English Acres,
1.—From Mr. RICHARD GRIFFITH, jun. on the Eastern extremity of the Bog of *Allen*, in the county of Kildare -	36,430
2.—From Mr. RICHARD GRIFFITH, jun. on the District of the River *Barrow*, in the county of Kildare - - - - -	41,075
3.—From Mr. JONES; on the District of the River *Boyne*, in the counties of Meath and Westmeath - - - - - -	42,370
4.—From Mr. LONGFIELD; on the District of the River *Brusna*, in the King's county - - - - - - - -	44,594
5.—From Mr. TOWNSHEND; on the District of the River *Shannon*, in the counties of Westmeath, Longford, and the King's county - - - - - - - - -	34,500
6.—From Mr. EDGEWORTH; on the District of the River *Inny* and *Loughree*, in the counties of Lougford and Westmeath,	34,569
7.—From Mr. LONGFIELD; on the District of *Lough Gara*, in the counties of Roscommon, Sligo, and Mayo - - -	83,689
8.—From Mr. AHER; on a District lying between *Roscrea* and *Killenaul*, situated in the counties of Tipperary, Kilkenny, and the Queen's county - - - - - - - -	36,025
9.—From Mr. AHER; on a District lying to the Westward of *Maryborough*, in the Queen's county - - - -	14,754

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	Containing, of Bog, English Acres,
10.—From Mr. COCKBURNE; on a District forming the *Western* extremity of the county of Clare - - - - - -	22,340
11.—From Mr. BRASSINGTON; on a small District on the banks of the River *Barrow*, in the counties of Kildare and the King's county - - - - - - - - - -	7,459
12.—From Mr. JONES; on the District of *Lough Corrib*, in the counties of Galway and Mayo - - - - - -	83,724
13, 14, 15.—Three Reports from Mr. BALD; on three Districts in the county of *Mayo* - - - - - - - -	161,962
16.—From Mr. TOWNSHEND; on a great District surrounding *Lough Neagh*, and extending to the mouth of the River *Bann*; situate in the counties of Antrim, Down, Armagh, Tyrone, and Londonderry - - - - - - -	64,855
Exclusive of 10,673 acres of Land inundated by the winter level of the lake.	
17.—From Mr. NIMMO; on the District of *Iveragh*, in the county of Kerry - - - - - - - - - -	43,567
18.—From Mr. NIMMO; on the District of the River *Kenmare*, in the county of Kerry - - - - - - - -	14,605
19.—From Mr. NIMMO; on the District of the Rivers *Laune* and *Lower Maine*, in the county of Kerry - - - -	17,990
20.—From Mr. NIMMO; on the District of the *Upper Maine*, in the county of Kerry - - - - - - - -	8,566
21.—From Mr. NIMMO; on the District of *Slieve Laughar*, in the counties of Cork and Kerry - - - - - - -	32,902
22.—From Mr. NIMMO; on the District of the River *Cashen*, in the North of Kerry - - - - - - -	31,514
23.—From Mr. EDGEWORTH; on a second District contiguous to *Loughree*, in the counties of Longford, Leitrim, and Roscommon - - - - - - - - -	26,630
24.—From Mr. R. GRIFFITH, jun. on the Southern Extremity of the River *Suck*, in the counties of Galway and Roscommon,	76,848
25.—From Mr. R. GRIFFITH, jun. on the Northern Extremity of the same District - - - - - - - -	52,390
	1,013,358;—

Making a total of 1,013,358 English acres of Bog, minutely surveyed and levelled; forming the subjects of 25 Reports, and embracing the opinions of ten different Gentlemen, who have devoted, as appears sufficiently from their Reports, no small time and labour to the investigation.

In addition to these we have, as already stated, received three Reports, not professing to enter into the same detail, upon the three Mountain Districts of *Wicklow*, *Erris*, and *Cunnemara*.

Of these,	
The *Wicklow* District appears to contain, of common red Bog,	97,000
The District of *Erris* - - - - - - -	170,000
The District of *Cunnemara* - - - - - -	120,000
Exclusive of the Peat Soil, which forms the general covering of the Mountains within these three Districts, and much of which appears very reclaimable for pasture, by the simple process of laying out intercepting drains.	
Of this Mountain Soil there appears to be,	
In the *Erris* District - - - - - - -	155,500
And in *Cunnemara*, about - - - - - -	200,000
No particular return is made of the quantity in the District of county of *Wicklow*, but it is, no doubt, very considerable.	
Mr. Nimmo further informs us, that the Mountains of *Slieve Laughar*, *Slieve Mash*, and *Corgaginny*, containing, according to him - - - - - - - -	500,000

There are besides, in the counties of Donegal, Tyrone, and Fermanagh, very extensive tracts of Mountain similarly circumstanced. These we have not been able to make the subjects of our Surveys, nor do we think that there is much reason to regret the omission, being persuaded that their proprietors, when disposed to undertake their improvement, may find, in the Reports which we have already submitted to Your House, every information to be obtained upon the subjects. Judging, however, from the maps of this North-western extremity of Ireland, and comparing them with the extent of the other Mountain Districts whose contents we have ascertained, we are disposed to believe that they cannot contain, of Peat Soil forming the covering of these mountains, less than 400,000 English Acres.

In forming our opinion, as to the total aggregate amount of the Bogs in Ireland, it is very necessary to advert to the Bogs of less content than 500 acres; of these it is difficult

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or impossible to form an estimate with any degree of accuracy; we are not however, altogether without data. Examining Mr. Larkin's minute and excellent map of the county of Cavan, in his presence, we perceived it to contain about 90 Bogs, no one of which extended to 500 acres, and yet containing no less than 17,600 English acres in their collective amount.

This county comprises about 1-40th of Ireland; there are, however, few or perhaps no other parts of the Island, in which these small Bogs are so much interspersed. On the whole, we cannot suppose the other parts of Ireland contain less than ten times as great an extent of these lesser Bogs, as the single county of Cavan.

From all the above data, we can confidently pronounce, that the extent of Peat Soil in Ireland exceeds two millions eight hundred and thirty thousand English acres, of which we have shewn at least 1,576,000 to consist of flat red Bog, all of which according to the opinions above detailed, might be converted to the general purposes of agriculture; the remaining 1,255,000 acres form the covering of Mountains, of which a very large proportion might be improved at a small expense, for pasture, or still more beneficially applied to the purposes of plantation; we wish indeed it were possible for our Reports to fix the attention of their proprietors upon this subject, so connected with the interests of the British Empire.

We cannot dismiss this part of the subject, without again adverting to a prejudice not less extensive than that of the irreclaimability of Bog, and certainly still more destitute of foundation; we mean, the apprehension generally entertained, that in the event of the improvement of the Bogs, the country would be left without a sufficient supply of Fuel. It seems not to be generally understood, that if the Bogs of Ireland were reclaimed, we should derive not merely the advantage of cultivating their surface, but that at the same time the power of applying them, wherever necessary, for fuel, would be augmented some hundred or rather some thousand fold. Fuel can at present be obtained only from the edges of these Bogs; the excessive wetness of the interior, rendering it, in its present state, wholly unavailable for that purpose, but if once drained, fuel might be obtained from every part of them: And it is a great mistake to suppose, that the drainage of a Bog would impair its quality as fuel; on the contrary, it would operate as the greatest possible improvement of it, and that not merely at the time it was effected, but at all future periods, and in a degree progressively increasing.

In the prosecution of these inquiries, we have effected, on the great scale of 4 inches to the mile, the most accurate Surveys which have ever been made, of a very large portion of this Island. On a perusal of the Act under which we have been appointed, we find nothing to direct us with respect to the final application of these documents, and we have accordingly exercised our discretion in presenting them to the Dublin Society, who have so liberally accommodated us with the use of their house and establishment, for the purposes of an inquiry. These maps, accompanied by the original Reports of the Engineers, will form an appropriate appendage to an Institution, which has ever made the agricultural improvement of Ireland one of its principal objects, and in no other place would their preservation be more certain, or public access to them so easy.

We regret that the trigonometrical connection of these Surveys, which we formerly proposed, has been found, for the present, to exceed our powers, owing to the necessity under which we found ourselves of employing the gentlemen to whom we wished to entrust it, in completing the other Surveys within the time allotted for our existence as a Board. This is an object, however, which at any future day can without difficulty be resumed.

We subjoin, in the Appendix, No. 1 & 2, an Account, continued under the same Headings as formerly directed by Your Honourable House, for the period which has elapsed since the last Account which we submitted.

We regret, that an estimate of the sum has proved erroneous. The nature of our inquiries has been such, as to preclude the possibility of foreseeing, with any tolerable precision, what expense would be required. On the winding up of our Accounts, we are deficient in the sum of £.452. 12*s.* which we humbly hope Your Honourable House will be pleased to enable us to discharge. We can indulge the gratifying reflection, that, during a period of upwards of four years, in which our inquiries have been continued, the entire expenses to the Public of the establishment of our Board, have been confined to the mere salaries of our Secretary and one clerk; during the first 15 months of this period, we allowed to the former £.200, and to the latter 50 guineas per annum. The great and unforeseen accumulation of Correspondence and Accounts which then ensued, and the increasing responsibility which fell upon our officers, determined us to augment their salaries at that time, the former to £.300, and the latter to £.100 per annum. During the last half year, their business has been inconsiderable, and we have thought it right, with their consents, to retain their Services, but to discontinue their salaries during that time altogether.

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	WILLIAM GORE.	(L. S.)
	HENRY HAMILTON.	(L. S.)
	HANS BLACKWOOD.	(L. S.)

(5.) EXTRACTS

(5.)

EXTRACTS FROM THE APPENDIXES.

EXTRACTS FROM THE APPENDIX TO THE FIRST REPORT.

REP. I.—Mr. *Griffith*, on the eastern part of the bog of Allen; his general observations; letter from the bishop of Kildare; plans for drains, &c.—with one Plate, Section and analysis of part of the Timahoe bog.

Mr. R. Griffith, on Part of the Bog of Allen.

IN answer to an assertion made by some persons, that a Bog deprived of water is a caput mortuum, on which no plant will vegetate, either spontaneously, or by any alteration in the composition of its surface that can be effected; it may be observed, that although Bog when first drained appears to have lost the power of supporting aquatic plants, without a capability of supplying food for the vegetation of plants of a different and more useful nature; still, if we have patience till the Bog-moss*, &c. which composes the upper surface of the Bog, shall have subsided, and by the near approach of their mossy fibres (which when alive are kept asunder by water) and exposure to the atmosphere, shall become (to a certain degree) putrid, it will be found that various grasses of good quality, and even white clover, will vegetate spontaneously on its surface.

Drained Bog supposed by some persons to be a caput mortuum.

But it is not to be supposed that an active people will thus suffer Nature, unassisted, slowly to attain a desirable alteration in the upper surface of drained Bogs; they will naturally join hand in hand with her, and by the simple process of digging or ploughing up the surface of the drained Bog, and by gathering it into heaps, and (in dry weather) setting fire to them (having previously mixed a portion of clay amongst the heaps, which is always to be found in inexhaustible quantities beneath the Bog) accomplish in two years, what Nature, unassisted, might have attained (less perfectly) in ten.

The process of reclaiming Bogs and spreading Clay on its surface, and afterwards burning the Clay and surface of the Bog together.

Clay is universally found beneath the Bog.

This species of manure, which by long experience, both in this country and in Scotland, has been ascertained to be the most efficacious in altering the properties of pure peat, is the Ashes of Peat, taken from the most solid part of the Bog nearest the bottom. The composition of these Ashes is usually found to be burnt clay, containing a large proportion of oxyd of iron, and a small proportion of charcoal.

The Ashes of Peat dug from the bottom of the Bog, have been found very efficacious in altering the properties of pure Peat.

These Ashes are composed of Clay and Charcoal.

From this analysis we may be led, with tolerable certainty, to draw the conclusion, that Clay taken from the bottom of the Bog, which must be similar to that contained in the Peat immediately above it, and mixed and burned with the Moss that forms the upper part of the Bog, would (by increasing the quantity of the Clay) have more effect in the decomposition of Peat, so as to render it capable of affording nourishment to plants of almost every description, than the Red Ashes produced by the under stratum of the Bog alone, which, as already stated, has been universally approved of.

It is supposed that Clay taken from the bottom of the Bog, and burned with the surface, would yield Ashes equal if not superior to Red Ashes.

Mr. Nasmith, of Hamilton, in his admirable Essay on the Properties and Uses of Peat, states, that cohesive earth, which has suffered torrefaction (such as brick dust), is a most powerful solvent of peat; and in this he is borne out by numerous experiments made by himself, though rather on a too small a scale.

Mr. Nasmith found brick-dust a powerful solvent for peat.

The next manure in value to ashes is Lime, which, however, should be used but sparingly in the first instance; but it is admirable in producing sweet herbage in surface dressing on reclaimed Bog; and I mention this, the rather as I have lately heard persons (who might have been better informed) speak of Lime as being greatly superior to *all* other manures in reclaiming Bog.

Lime should be used sparingly in the first instance; but it is admirable in producing sweet herbage in surface dressing on reclaimed Bog.

Improvements already Effected.

The only attempt of any consequence hitherto made, towards reclaiming or cultivating part of the Bog in this division of the District, is on the north-west side of Clane Bog, called Betaghstown †. Single patches (seldom exceeding ten or twelve acres) may in other places be

Patches of reclaimed Bog, seldom exceeding 10 or 12 Irish acres, are observable along the edges of most of the Bogs.

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[*] Sphagnum Palustre.—The pulp of the Bog, as has been already oberved, is composed of varieties of this Moss. To exemplify, as far as possible, the various stages of decomposition which the Moss has undergone between the top and bottom of a deep Bog, I have added at the end of this Report a Section, with a description and analysis of every variation in the colour and composition of the Moss, from the top to the bottom of a Bog of 38½ feet in depth.

[†] The Bishop of Kildare, under whose direction the improvements on the Bog of Betaghstown are carried on, has done me the honour of communicating to me his ideas on the Reclamation of Bog, in the following interesting Letter; in which the mode of proceeding he has adopted will be found most correctly and fully detailed;—

"Glasnevin House, 1st June 1810.

"Dear Sir,

"The Bog of Betaghstown lies a little elevated above a Morass, which had formerly been a Lake. In 1806, the levels of an old Drain, by which this change appears to have been effected, being judged capable of correction, were

Letter from the Bishop of Kildare, describing his improvements in Betaghstown Bog.

(5.)
EXTRACTS
from the Appendixes to preceding Reports.

The usual process of reclamation is, spreading Clay on the surface of the drained Bog, and afterwards burning the surface and Clay together.

The first Crop is Rape, which yields usually 10 barrels of seed.

Second crop, Oats; and the third, with some manure, Potatoes.

be observed in a state of semi-reclamation along the edges of most of the Bogs. The mode of proceeding usually adopted in reclaiming the Bog, is as follows, viz. The part intended to be cultivated being drained, or partially drained (the latter most generally, on which account the crops often fail) the surface is ploughed, or dug up, and gathered into heaps, amongst which clay, or limestone gravel, is usually mixed; when sufficiently dry, the heaps are set on fire, which burn slowly, and leave usually a considerable quantity of red ashes, which are spread on the surface of the Bog; the Bog is afterwards ploughed or dug a second time, but deeper than the first; these operations being performed, the field is ready for sowing. The first crop is Rape, which in dry years is usually productive, yielding about 10 barrels of seed per acre, and sometimes more; the next crop is generally Oats, and afterwards (with a portion of manure) Potatoes, as it suits the convenience or fancy of the farmer; no regular succession of crops having as yet been generally adopted.

ESTIMATE of the Expense of Draining the several Bogs contained in the Eastern Division of District, No. 1.

Preliminary Observations to the Estimate:

IN an undertaking so novel as that of a general Draining of the Bogs, in which no considerable degree of experience has yet been attained by any one, I felt considerable difficulty in appreciating the value and quantity of work to be performed upon any given Section through the Bogs. I have therefore deemed it my duty to make very minute inquiry into the progress of the Drainage of the several Bogs through which the Royal and Grand Canals have been executed, as well in respect to the prices of original, secondary, and final cutting of the Drains, as in respect to the probable quantity of increased cutting that may be produced by the rising and collapsing of the Bog in the progress of its drainage.

The fallacy of Estimates is (perhaps too justly) become proverbial, and the Commissioners would have had but little reason to confide in an Estimate made by an Engineer, unless he had (as I have endeavoured to do) made himself fully acquainted with the general progress and detail of all the works of this nature executed in Ireland.

In

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were also further deepened; and thus the lowest Pits in the Morass, a considerable portion of the Bog, together with some adjoining Fields (of which the annual produce was both scanty and precarious) were commanded and rendered level free.—The whole area, indeed, floated on water, having a bottom composed of marly Clay and Limestone-gravel, a substance of great value, and peculiar to Ireland. In 1807, four interior parallel Drains, fifteen feet each in width, were cut towards the higher edge of the Bog through the Morass, which proved to be eight feet in its least, and twenty-two feet in its greatest depth.

" At right angles, covering the heads of these, and within a few yards of the Bog, a Catch-water Drain was constructed of twenty feet in width, and in depth varying from sixteen to twenty-two feet. Twenty-six plantation acres of no value, were thus converted into solid ground, and by its Drains at top, bottom, and middle, enclosed in parallelograms, all having an equal and free drainage to the main, or commanding outfall.

" In the commencement of this undertaking, serious difficulties were suggested by the neighbours, many of whom were persons of sound judgment and competent skill. The most important of these seemed to consist in the probability, that a deep mass of spongy and almost fluid matter would collapse, choak up, and endanger the lives of the persons employed in cutting the Drains; it was therefore determined to commence and to finish each reach, down to the gravelly bottom, on the same day; because it was imagined, that the bottom, being hard and level free, would furnish a seat on which the sponge would compress as the water should subside. Instead of cutting the sides of these Drains in a sloping shape, or batter, they were, at convenient points of descent, formed into benches or steps, on either side the projecting base of each, supporting the perpendicular pressure of that above it. In all this we were successful, and the operation had an immediate advantage.—Its first effect was, to render perfect the former defective Drainage, to give solidity to the fluid Morass, and to reduce the height of the Bog by withdrawing a portion of its water. No disaster has since befallen the work; the surface has continued to sink; where the depth was twenty-two feet it is now 8 or 9, and the Catch-water Drain, without collapsing, has by pressure reduced its former surface width to seven or eight, leaving the side steps or benches scarcely perceptible; and instead of a Water way, as at first, three feet, there is only a bottom run of 12 to 16 inches. In 1808, the Morass was judged solid enough for the plough; but to avoid any danger of sinking, the legs of the horses were enveloped with hay-bands to increase their volume.

" It is here proper to state, that the land acquired, or relieved from the superabundant moisture by this process, was, in the whole, fifty-five Irish, or eighty-nine English statute acres; twenty acres, the driest of these, were, in the winter of 1808, well covered with the marly Limestone-gravel already mentioned; and in 1809, together with 16 acres of the former Morass, ploughed, heaped, and burned, with ample success, sown with Rape (otherwise called Coleseed) on which were profitably lodged and fed a considerable number of sheep, in the last winter and spring, in the manner of the Isle of Ely and Lincolnshire farmers; and now there are thirty-three acres of Oats, having the most promising appearance.

" The action of fire on the Morass was satisfactory and complete; but it will be proper, in the course of a few years, to dress it with Limestone-gravel, and to renew it by burning; for it is to be observed, that the gravelled portion of ground, which had formerly been imperfectly improved, had become of very small value: it had been even gravelled at some remote period, a circumstance which was disclosed by the plough; but when heaped and burned, the old and new Limestone-gravel was converted into Quick Lime, blended in the spreading with a renovated soil, and slacked by the weather.

" As we have hitherto had no succession of corps, I cannot give an answer to that point of your inquiry; but it is very much in my thoughts, that all the lands thus acquired from a former state of worthlessness, or improved to a great value, may henceforward be subjected to any reasonable course of husbandry.

" According to our present intentions, they will be continued in an alternation of Green feeding and Oaten crops, with the second division of this acquisition to be treated during the present season in the same manner.

" It has already, without doubt, appeared to you, that the works begun are merely bases to further lines of Drainage, operating on the greater Bog, which will be gradually executed, as the pecuniary circumstances of the place, or any private assistance, may furnish the means.

" In conclusion, therefore, it may generally be stated, that some portion will, according to a regulated succession, be laid down with Grass. That the Straw and Hay obtained from this part of the farm, will be expended for the benefit of the old and worn soils of uplands equally, belonging to Hewetson's Institution for Agriculture and Education; and at stated periods, and in regular progression, these low grounds will be ploughed, heaped, and burned, till by this treatment, and by time, they will compress to the present substratum, which it will be the object of future cultivation to blend and mix in tillage with the vegetable surface that may then be remaining.

" I have the honour to be,
" Dear Sir,
" Your obedient and faithful Servant,
" CHARLES KILDARE."

Richard Griffith, jun. Esq. &c. &c.

(3.) EXTRACTS *from the Appendixes to preceding Reports.*

Rep. I. Mr. Griffith.

In order to avoid the possibility of the expense of the execution of this work exceeding the Estimate, I have superadded an allowance of 15 per cent. for contingencies, together with 5 per cent. for the salaries of officers during the progress of the work.

In order to afford the fullest satisfaction in my power to the Commissioners, of the principle upon which the annexed Estimate is formed, I have given the quantity of yards in the running perch of the work to be executed in the different Drains according to the Sections, together with the rates per yard and per perch, at which I conceive the work may be finally executed; in which prices or rates I have made allowance for second and third sinking and widening in the Bogs; and having made the allowance in the price, I have not superadded the increased work in those secondary and final operations.

The second and third operations above alluded to are mostly confined to the minor Drains, as the above main Drains are in general laid out in the beds of rivers and streams running through the Bog, where, in most instances, little Bog and some gravel is only to be removed, and the courses of the rivers or streams straitened, and their beds widened and deepened.

As it will probably be supposed by many persons, that 2 feet, which is the whole breadth that I have allowed for the bottom of the proposed main Drains, will not be found sufficient; I think it necessary to mention, that my reason for determining on that breadth of bottom is, that it has been found by experience in the Bogs passed through by the Grand Canal, that where there was any fall, deep Drains with narrow bottoms were kept clean at bottom by the running water; but that the contrary was the case where their bottoms were made broad, as the same quantity of water being thinly spread over the bottom in the latter instance, was not sufficient to carry off the peaty particles it contained, but deposited them on the bottom of the drain, which, on this account, required frequent scourings.

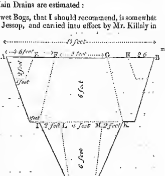
Plan upon which Main Drains are estimated:

Cross Section of a main Drain.

Process of execution.

The mode of cutting main Drains in very wet Bogs, that I should recommend, is somewhat similar to that originally (proposed) by Mr. Jessop, and carried into effect by Mr. Killaly in draining the deep and wet Bogs in the line of the Grand Canal between Tullamore and the River Shannon.

Suppose the figure A B C D to be the Section of a main Drain when finished; the mode of proceeding that I should recommend, would be; first, that the small Drains A E and H B should be sunk at the edges the whole length of the main Drain. These Drains will have considerable effect in consolidating the Bog, immediately on either side, so as to enable the workmen to return in a few weeks to cut the Drains A F and G B; when these shall be finished, there will remain in the center the core F G K I, which will have two beneficial effects; first, it will effectually prevent the bottom from rising, and the sides from collapsing; and secondly, by suffering the core to remain some months, it will lose so much of its water as to reduce its weight to less than one-half, and in that proportion diminish the expense of its final removal. When the core F G K I shall be removed, the Drain L M C D should be sunk. The Bog stuff may in the first instance be thrown on the benches I L and M K, and from thence cast to the surface: those benches, on the finishing of the work, will be removed.



Whoever has observed the process of draining Bogs, will be satisfied that it can only be effected by a slow and gradual operation; and when the works are of considerable extent, neither labour nor time will be lost by the mode above suggested, as the labourers will find constant employment by a regular rotation in their operations as the work proceeds.

Expense of the different classes of Drains, abstracted from the Estimate:

In the present early progress of the inquiry into the important subject of Draining the Bogs, it is not possible to conjecture to what degree it may be deemed expedient to extend improvement, as it is probable that the decision in this point will depend on the amount of the expense to be incurred in effecting the different degrees of drainage.

I have, in order to place this matter in as clear light as possible, made three abstracts from the General Estimate, in which I have divided the expense into three several stages of improvement, each including its portion of Incidents and Superintendence, by which the Commissioners will see at one view,—

1st. The expense of executing the main Drains, including the deepening of the Rivers, without which no effectual main Drain can be made; which amounts in this division of the District, containing 22,490 Irish acres, or 36,430 English acres, to the sum of £. 27,749. 10s. 4d.

2d. The

(5.)
EXTRACTS
from the Appendixes to preceding Reports.

Rep. I. Mr. Griffith.

2d. The expense of executing the main Drains, as a base with the addition of minor Drains, amounting to the sum of £. 49,268. 9*s.* 4*d.*

And, lastly, the whole expense of the operations, which I deem necessary for completely draining this division of the District, including main, minor, and cross Drains, amounting to the sum of £. 70,014. 7*s.* 3*d.*

Description of the Section:

The foregoing Section is an exact representation of a Turf Bank on the southern edge of Timahoe Bog.

The surface of the Bog has been partially drained for about 20 perches into the interior, which has occasioned the upper, and most porous part, to subside 3 feet, the fibres of moss having lost their watery support, and not being sufficiently strong in themselves to retain their former elevation. The annual growth of moss on this Bog being prevented by the absence of water, it may be considered as dead.

* p. 157 ante.

In the Report, page 30*, I have stated, that in drained Bogs, when the Bog-mosses, &c. which compose the upper surface shall have subsided, and by the near approach of their mossy fibres (which when alive are kept asunder by water) and their exposure to the atmosphere shall become (to a certain degree) putrid, it will be found that various grasses of good quality, and even white clover, will vegetate spontaneously on its surface.

The Bog, of which the Section is the face, has now been superficially drained for three years, and the effect above described has taken place to a certain degree, as the common meadow, the Tivrin, or jointed grass, and white clover, are now growing on its surface, though sparingly; and the surface of the Bog has been so far acted upon by the atmosphere as to have totally lost the texture of the moss, and to have assumed a close-grained earthy appearance; whilst in the bed immediately below it, the mossy fibres are so perfect, as to render the different species perfectly distinguishable to the botanist, as may be seen by the specimens which I now lay before the Commissioners.

Description and Analysis:

No. 1. - - - 2 feet thick.

Surface of Bog decomposed by exposure to the atmosphere: mass compact; contains rarely any vegetable remains; where they occur they are chiefly composed of fibres of moss in the last stage of decomposition, and decayed branches of heath.

Colour, - - - reddish brown:
Specific gravity - ,895.

1,440 grains of this substance yielded but 20 grains of white ashes, which are found to be composed of vegetable matter.

No. 2. - - 3 feet thick.

The mass is here very open-grained and fibrous; the moss is usually so perfect, that the different species are easily discernible to the botanist: the sphagnum palustre is observed greatly to predominate.

Colour, - - - light reddish-brown:
Specific gravity - ,356.

1,440 grains of this substance yielded but 12 of white ashes, of similar composition to No. 1.

No. 3. - - 5 feet thick.

Mass open-grained and fibrous; varieties of moss visible, but not so perfect as in No. 2: used as turf, but burns badly, on account of the openness of its texture, and its containing no empyreumatic oil.

Colour, - - - pale yellowish-brown:
Specific gravity - ,408.

1,440 grains of the dried peat yielded but 11 grains of white ashes, of similar composition to the foregoing.

No. 4. - - 8½ feet thick.

Mass tolerably compact, but still fibrous; when used as turf, it burns tolerably well.

Colour, - - - deep reddish-brown:
Specific gravity - ,871.

1,440 grains of the dried peat yielded 12 grains of yellowish white ashes, composed of vegetable matter, with a tinge of oxyd of iron.

No. 5. - - 3 feet thick.

Mass compact; fibres of moss rarely discernible*; numerous twigs, and small branches of birch, alder, and fir-trees, are observable amongst the peat in this part of the Turf Bank. Upon near inspection it was found, that all the branches and twigs were quite hollow; the wood being decayed had disappeared, leaving the bark perfect. This division of the Turf Bank, when used as turf, burns pleasantly, but quickly.

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* Branches are not found contained in the body of the Bog generally, and even at the edges not universally.

Colour, - - - blackish-brown:

Specific gravity - 1,030.

	Grains.
Analysis.—1,440 grains yielded, of volatile empyreumatic oil - - -	140
Of water, containing a small portion of oil that could not be separated - - - - - - - - - -	834
Light porous charcoal - - - - - - - - -	298
Carbonated hydrogen gas, which burned with a clear bluish white light, equal, if not superior, to the coal gas - - - -	168
	1,440

500 grains of this charcoal yielded 15 grains of light yellowish-white ashes, composed of vegetable matter, and a slight tinge of oxyd of iron.

No. 6. - - 3 feet thick.

Mass compact; contains no vegetable remains; when used as turf burns swiftly, and with a bright flame; it is usually denominated greasy turf, from its inflaming quickly like grease.

Colour, - - - dull yellowish-brown:

Specific gravity - ,694.

	Grains.
1,440 grains yielded, of volatile empyreumatic oil - - - - -	180
Water, containing a small portion of oil that could not be separated -	816
Light porous charcoal, which, when broken, exhibited a faintly shining lustre - - - - - - - - - - - - -	327
Gaseous product, which, when ignited, burned with a bluish white light, similar to No. 5 - - - - - - - - -	117
	1,440

500 grains of this charcoal yielded 16 grains of yellowish-white ashes, similar in quality to No. 5.

No. 7. - - 10 feet thick.

Mass very compact; no vegetable remains visible; when used as turf burns slowly, and with an unpleasant smell.

Colour, - - - blackish-brown.

Fracture earthy, with a tendency to conchoidal; lustre, when first broken, faintly glimmering.

Specific gravity - - 1,057.

	Grains.
1,440 grains yielded, of volatile empyreumatic oil - - - - -	138
Of water, containing a minute portion of oil that could not be separated	538
A very compact charcoal, internal lustre glistening - - - -	590
Gaseous product - - - - - - - - - - -	174
	1,440

500 grains of this charcoal yielded of deep reddish-brown ashes 50 grains, which are chiefly composed of oxyd of iron.

No. 8. - - 4 feet thick.

Mass very compact; contains no vegetable remains; is seldom used as turf, owing to the unpleasant smell it gives out when ignited.

Colour, - - - black.

Fracture conchoidal in every direction; lustre shining; exhibits a strong resemblance to pitch or pitch coal; and is susceptible of a high degree of polish.

Specific gravity - - - 1,236.

	Grains.
Analysis.—1,440 grains yielded, of volatile empyreumatic oil - - -	124
Water, containing oil that could not be separated - - -	582
Charcoal very compact, internal lustre strongly glistening - -	566
Gaseous product, which burned with a bright light, but unpleasant smell - - - - - - - - - - -	168
	1,440

500 grains of this charcoal yielded 96 grains of brick-red ashes, which are found to be chiefly composed of oxyd of iron.

(5.)
EXTRACTS
from the Appendixes to preceding Reports.

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No. 9. - - - 3 feet thick.

Marl; colour, yellowish-white; does not adhere to the tongue.

100 parts contain:

	Grains.
Carbonate of lime - - -	64
Silex - - - - - -	24
Alumine - - -	12
	100

No. 10. - - - 4 feet thick.

Yellowish blue clay; adheres strongly to the tongue.

100 parts are found to contain:

	Grains.
Alumine - - - - -	72
Carbonate of lime - -	6
Silex, coloured by oxyd of iron -	22
	100

Being very much pressed for time in making the foregoing Analysis, I have been obliged to attend merely to the most useful results. I hope, however, in a future Report, to be able to lay before the Commissioners a more detailed Analysis, containing a minute examination of the composition of the ashes contained in the charcoal, and also the exact composition of the gaseous products.

EXTRACTS FROM THE APPENDIX TO THE SECOND REPORT.

REP. II.—Mr. *Griffith*, on the western part of the bog of Allen, in King's and Queen's counties; with Two Plates, viz. a Ground Plan and Section, of the drains in Geashill bog;—dimensions and number of drains; various species of bog manures; improvements, &c.

Mr. R. Griffith, on Part of the Bog of Allen.

Dimensions and Number of Drains proposed.

Dimension of Drains.

IN laying out Drains for the discharge of the waters from the Bogs, which compose the western Division of this District, I have thought it necessary to add to the three classes of Drains already proposed in my former Report, a fourth class, which I shall call *Surface Drains*, as I have found from additional experience, that Bog Fields of 10 Irish Acres would be too large for convenience, and also that in certain situations the centre of the Field might remain too wet for agricultural purposes.

Main drains 14 feet top, 2 feet bottom, and 12 feet deep.

Minor drains 9 feet top, 1 foot bottom, and 8 feet deep.

The order and dimensions of the several Drains now proposed are, first, main Drains, which are placed in the lowest situations; their dimensions are proposed to be 14 feet top, 2 feet bottom, and 12 feet deep*. In the main Drains, smaller ones, which I have called minor Drains, are proposed to be cut, generally obliquely from the summits of the Bogs to the main Drains, so as to take advantage of the greatest possible fall; their dimensions are 9 feet top, 1 foot bottom, and 8 feet deep; these minor Drains are proposed to be carried at the distance of a quarter of an Irish mile from each other.

Intermediate and cross Drains 6 feet top, 1 foot bottom, and 5 feet deep.

Intermediate between the minor Drains it is proposed to cut Drains of still smaller dimensions, viz 6 feet top, 1 foot bottom, and 5 feet deep, and further at right angles to the minor and intermediate Drains, a system of cross Drains of similar dimensions with the intermediate Drains, is proposed to be carried 280 yards asunder, which would divide the Bog into square fields of 10 Irish acres.

Surface Drains, in conjunction with the others; these Drains will divide the Bog into rectangular patches, containing 3½ Irish acres.

The additional class of Drains now proposed, viz. surface Drains, are intended to divide the 10-acre fields into three parts, by two Drains to be cut parallel to the minor and intermediate Drains, that is, in the direction of the fall.

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* In my Report on the Eastern Division of this District, I have given a Section of the form and description of the Process which I should recommend to be followed in sinking main Drains. See First Report of Commissioners for Drainage of Bogs in Ireland.

The whole of the foregoing Drains, if executed, would divide the Bog into rectangular patches 280 yards long, by 93½ broad, which is equal to 3½ Irish acres.

The dimensions of the surface Drains are 4 feet top, 1 foot bottom, and 3 feet deep.

Dimensions of the Surface Drains are 4 feet top, 1 foot bottom, and 3 feet deep.

In the annexed Plate, (No. 3,) containing an enlarged Map of Geashill Bog, the whole of the proposed Drains are laid down in their proper situations, though not exactly according to the plan above described, which irregularity is owing to the public road from Rosinallis to Geashill crossing the Bog between the summit and the principal fall.

The whole of the proposed Drains are laid down in Plate No. 3.

Owing to peculiar circumstances the system of Drains described has not been exactly followed in Geashill Bog.

It is impossible to lay down any general system of Drains which could be accurately followed in every instance; local circumstances must always be attended to; and every general plan, however perfect, must in some degree arrange itself according to them.

This must frequently be expected, as general systems must give way to local circumstances.

I deem this general system of Drains quite sufficient for that high and porous species of Bog which abounds in this part of the country, and which in the description of the several species of Bog I have denominated fibrous or red Bog.

Some persons may apprehend, that in very hot summers this porous Bog will become too dry; should this ever happen (and I do not mean to say it will not,) Sluices may be placed in the minor Drains so as to pen up the water in them, and in the cross Drains which run nearly at right angles to the fall; by these means the surface of the Bog may be easily moistened, and if it be wished, flooded, and the water will be discharged from one cross Drain into the next, which is on a lower level, and which, according to the plan laid down, should be 280 yards distant; by reference to Plates, No. 3, and 4, at the end of this Report, this will appear more clearly.

It may be apprehended, that porous Bog will become too dry in summer.

This may be avoided by Sluices being placed in the minor Drains.

By placing Sluices in the minor Drains A B, and C D, Plate, No. 3, at the points A and C, the waters running in the minor Drains will be backed into the cross Drain E F, and if thought necessary, may be made to flow over the surface of the great Bog-fields south of the cross Drain E F; the water flowing from the cross Drain E F, will be discharged into the cross Drain G H. The fall from the cross Drain E F, to the cross Drain G H, is shown in the Section of the minor Drain C D, Plate, No. 4; it is 2 feet 6 inches.

Reference to the Plates.

The practicability of draining very wet Bogs has been doubted by many sensible men; from the fact (which is undeniable,) that ten or fifteen yards towards the interior from the fall of a Turf-bank the surface of the Bog is frequently found extremely wet, and therefore, (it is said) if the surface of a Bog near the edge of a Turf-bank (from whence there is always a fall of at least 10 or 12 feet,) be not drained, it cannot be expected that any system of Drains will ever accomplish that end.

Practicability of draining wet Bogs has been doubted.

In answer to this most plausible argument it may be observed, that the surface of all Bogs near the edges is much lower than the interior where the springs are usually situated, which chiefly supplies the water contained in the Bog; the water from these sources naturally flows towards the exterior, which is on a lower level. How can it be expected that Turf-banks formed at the edges of Bogs so situated will prevent the flow of the water from the interior? but owing to the side-cuts usually made, will they not have a tendency to draw more water to those points than would have naturally flowed there? But if the Drains proposed in this Report were cut in any Bog, the water from the interior would be arrested in its progress towards the edge, and quickly discharged by the minor and cross Drains; the natural consequence of the adoption of such a system must be nearly perfect superficial consolidation.

Doubts answered.

In respect to the form which I have recommended for the several classes of Drains proposed in this Report, I have merely to mention, that I have been induced to adopt the plan, already detailed, from observing that similar Drains made by the Grand Canal Company in the Bogs of this District have answered perfectly well.

Reasons for recommending the proposed forms for Drains.

The chief desideratum in cutting Bog-Drains is the practicability of forming them in such a manner that they will keep themselves clean, and that their sides will have no tendency to fall in or collapse; the first of these objects may be attained by making the bottom of the Drains sufficiently narrow, that is, proportioned to the quantity of water which is likely to pass through them; and the sides may be prevented from falling in by giving them a sufficient slope; that which I have recommended is 6 inches increase of width on either side for every foot in height. Thus the proposed dimensions of minor Drains are 9 feet top, 1 foot bottom, and 8 feet deep.

Bog-Drains should be formed so as to keep themselves clean.

Their sides should be sloped to prevent their falling in.

I have seen Bog-Drains made with perpendicular sides, but always in firm Bog. I believe it to be utterly impracticable to form such Drains in very wet Bog; Drains of this description have always a tendency to choke, as they must necessarily be made 3 feet broad at bottom (if the Drain be 4 or 5 feet deep,) to allow the workmen room to throw out the Bog-stuff; their sides must also be expected to fall in, unless the Bog be very compact; even Turf-banks, which are always made in the driest and most compact parts of the Bog, frequently fall in in winter, and almost universally crack behind and hang over.

Bog-Drains, with perpendicular sides, must necessarily be too broad at bottom, and their sides will fall in if the Bog be wet.

Turf-Banks fall in in winter.

In fact, every kind of Bog-Drain in time will become narrower at top than when originally formed; those Drains already mentioned, made by the Grand Canal Company, were cut with a shape at least equal to that which I recommend; they have however now become considerably narrower at top. Had they been made originally with perpendicular sides

Even Drains, with sloped sides, will in time become narrow at top.

Drains, with narrow bottoms, and sloped sides, are cheaper than those with perpendicular sides.

they must have long since fallen in.—Economy too (which ought always to be a consideration of importance in great works) favours the form of Drain which I have recommended, as Bog-Drains made broad at top and narrow at bottom are much cheaper than those which are made of equal breadth at top and bottom; as the former contains fewer cubic yards in a running perch of work, and the principal part of the excavation is at the surface where no pitching is required.

The minor Drains should be deeper than the cross Drains.

It is necessary that the minor Drains, which are intended to receive the waters from the cross Drains, &c. should be made deeper as well as larger than them, otherwise the water being nearly on a level would have a tendency to stagnate in the cross Drains.

Having thus disposed of the first and principal step towards reclamation, viz. Drainage, I shall proceed to consider the different kinds of Bog which are usually met with, as a different mode of treatment will be found expedient for each sort.

Description of the Different KINDS of BOG which are found in this Country.

In this part of the country two distinct species of Bog may be observed, which I shall denominate fibrous or red Bog, and Quagmire, and compact or black Bog.

I am fully aware, that the naming any thing by its predominant colour has been much disapproved of by men of science, as being too vague; I am, however, induced to persist in this mode, in hopes of being better understood by country Gentlemen and Farmers, with whom the names of Red Bog and Black Bog are perfectly familiar.

Fibrous or Red Bog,

Is the most predominant species in this country.

It is chiefly composed of the Sphagnum Palustre or Bog-Moss.

Fibrous or Red Bog is the most predominant species in this Country; in fact the chief part of the surface of most of our extensive Bogs is composed of it; on minute examination it appears to be almost entirely composed of fibres of the Sphagnum Palustre (or Bog-Moss), in a very perfect state; its external appearance is usually reddish brown, when dry its colour is darker, and approaches to clove brown; in this state it is usually covered by common heath (Erica Vulgaris) which gives it at a distance an olive, or, if in blossom, a pinkish hue.

When very wet this species of Bog assumes a greenish colour, owing to its being covered by various kinds of Moss (but chiefly the Sphagnum Palustre,) which grow luxuriantly on the surface.

In the section of the Turf-bank in Timahoe Bog, which with its description, &c. forms the Appendix to my former Report, it may be observed, that the fibrous Moss continues from the surface to the depth of 10 feet, below which point the fibres become less perfect, and the gradation of colour, as well as the distinctness of fibre, continue progressively, the one increasing and the other diminishing without any interruption (if we except the adventitious interposition of a thin stratum, chiefly composed of twigs of Alder and Birch trees) between the Red and the Black Bog, the several varieties of which latter form the lower strata of that section.

In all Bogs, where the upper Surface is composed of Red Bog, we may expect the lower part to be composed of Black Bog.

From hence it appears, that in all Bogs where the upper part is composed of Red Bog, we may expect to find the lower composed of Black Bog; and in this supposition, we are borne out in the observation that those parts of the Bog which extend on a lower level, beyond the edge of the high Red Bog, where Turf has formerly been cut, are universally found to be Black Bog.*

Of Quagmire:

Quagmire.

Quagmire is only a variety of the red Bog: I have given this denomination to those parts of the red Bog which are so wet and soft as to render their interior nearly inaccessible; where they occur, the Bog is usually shallow, it seldom exceeds 14 feet in depth, and rarely amounts to 20 feet.

Quagmires usually occupy the most elevated situations in the Bog.

They are the seat of Springs.

Tufts of Grass and Bushes are found growing on the Surface.

They frequently occupy the most elevated situations in the Bog, and diverge from thence by winding courses of irregular breadth towards the edges. The interior of these Quagmires is usually the seat of springs, to the nutritious particles contained in the waters of which may be attributed the growth of tufts of the white grass, or soft meadow-grass (Holenes Lanatus) and the fiorin or jointed-grass, and also to stunted trees or bushes of alder and birch, which are universally met with in the very wettest Quagmires.

Of Compact or Black Bog.

Compact, or Black Bog,

Has sometimes a strong resemblance to Pitch, or Pitch Coal.

It contains rarely any vegetable remains.

Black Bog is supposed to have grown slowly under Water, and that the Red Bog commenced growing

The colour of this species of Bog varies from deep reddish brown to jet black; in the latter case the mass is perfectly compact, and has a strong resemblance to pitch or pitch-coal, the fracture being conchoidal in every direction, and lustre glistening. This kind of Bog contains very rarely any vegetable remains; where they do occur, I have always found them to consist of some of the varieties of rushes which grow in stagnant waters; from hence we may be led to conclude, that black Bog was formed, or grew slowly, under water, which will perhaps sufficiently account for the great difference of composition that exists between that species of Bog and the red Bog, which we may suppose to have commenced growing when the blag Bog had reached the surface of the water, and to have since

continued

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* I had intended to have given in this Report a perfect Analysis of the different varieties of fibrous and compact Bog, but a personal accident has prevented me from accomplishing it in time.

continued to vegetate, and to have annually increased in height above the water, and consequently above the level of the discharge, being constantly supplied with sufficient moisture by rain, or by capillary attraction from the water below. This supposition is strengthened by the fact, that twigs and branches of trees are sometimes found irregularly scattered at the point of junction of the Red and Black Bogs, see Section of the Turf-bank in my first Report.

when the Black Bog had reached the surface of the Water.

Compact or black Bog is frequently met with, unaccompanied by fibrous or red Bog, but in such cases it seldom forms great tracts; it is generally found in narrow strips, between the base of the gravel-hills which surround the Bog, and the abrupt edges of the red Bog, which rises frequently at an angle of 45° to the height of 15 or 20 feet above the surface of the black Bog. It is generally covered by a scanty coat of grass, which is of very little value on account of the great quantity of water by which it is overspread; in any part where the water is less abundant, or where it has been entirely, or even partially, discharged by drainage, the natural grasses may be observed growing; and on minute examination, white clover may sometimes be found vegetating amongst the grass.

It is sometimes found unaccompanied by Fibrous or Red Bog.

In those situations where Turf has been cut, black Bog, as above observed, is universally found; as the Turf-cutters are frequently prevented by the want of sufficient Drains from cutting deep into the black Bog, they necessarily leave the greater and by far the most valuable part of it behind them, as it is invariably found, that the compactness of the Bog increases with its depth, and the more dense the Turf, the better and more durable is the fire.

I shall now proceed to consider the several properties of the different manures which the Country affords, and which may be advantageously used in the reclamation of Bogs.

Of the several Manures which the Country affords.

In treating on this subject, I shall confine my observations entirely to the different fossil or earthy manures which are to be met with, either in the Bogs themselves, or in their immediate neighbourhood. The most important of which are,

Manures.

Lime and Limestone,
Limestone Gravel,
Tenaceous or Blue Clay, and
Turf Ashes.

Of Lime and Limestone.

Carbonate of Lime or common Limestone, is a mild substance, nearly insoluble in water; it is usually composed of nearly equal parts of pure lime and carbonic acid gas or fixed air; this aerial acid is very volatile; heat, when applied by the well known process of burning lime, will easily expel it; in this state it is said to be caustic.

Limestone.

It is composed of nearly equal parts of pure Lime, and Carbonic Acid Gas.

Caustic or quick-lime, when exposed for some time to the action of the atmosphere, or to animal or vegetable substances (which it quickly dissolves) attracts a greater proportion of carbonic acid gas than it contained previously to its being calcined; in this state it becomes again mild.

Lime.

The most simple mode of discovering whether Lime retains any degree of causticity, that is, whether it be or be not perfectly saturated with carbonic acid gas, is by applying a moistened piece of paper, stained yellow with turmeric to the surface of the Lime; if it be caustic, the colour of the paper will immediately be changed from yellow to red; if mild, no such effect will take place.

Process of discovering whether Lime be or be not caustic.

When Water is poured on caustic-lime, it quickly loses its compact form, and falls into a nearly impalpable powder; this substance is usually called slacked-lime, by Chemists Hydrate of Lime.

Slacked Lime,

Lime is not rendered less caustic by being slacked; the quantity of water which it absorbs, amounting generally to about one-third of its weight, has no other effect than that of dividing its particles; on exposure to the air the water contained in slacked-lime is quickly expelled, and carbonic acid gas is absorbed from the atmosphere, lime having a stronger affinity or attraction for carbonic acid gas than it has for water.

Lime is not rendered less caustic by being slacked.

Caustic or quick-lime is the best state in which that substance can be applied as a Manure to boggy soils, as it has the effect of quickly dissolving the vegetable substance with which it is placed in contact.

Caustic Lime is best suited to the improvement of Bog.

In the process of decomposition the vegetable substances give out carbonic acid gas which is attracted by the lime; the lime thus becomes mild, and is rendered capable of affording nutriment to plants, by gradually giving out the fixed air which it had absorbed from the decomposing Moss.

This process does not render the lime again caustic, as fixed air is as quickly attracted from the atmosphere as it is absorbed by the plants.

Mild Lime when used as a Manure on Bog, has no effect in decomposing the Moss, it therefore remains dead till called into action by the growth of plants.

Mild Lime has no effect in decomposing the surface of Bog.

—(5.)—
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from the Appendixes to preceding Reports.

For the same reasons that caustic or quick-lime is the best mode of applying that substance as a Manure to Bog, it is improper for upland, particularly when used as a surface dressing on grass; a very dirty fallow might however be benefited by a cautious admixture of caustic-lime, as it would have a tendency to dissolve the roots of noxious weeds.

Gypsum.

Has not been found in Quarries in the provinces of Leinster and Connaught.

Lime combined with carbonic acid is not the only state in which that substance is found in quarries; Gypsum (that is lime combined with sulphuric acid) is found in considerable quantities in the north of Ireland, but has not been met with, nor do I believe it exists, in quarries in the provinces of Leinster or Connaught.

On this account it is not necessary to dwell on its effects in this place as a Manure; I shall only add, that where it has been used in large quantities, it has been found destructive to vegetation.

Magnesian Limestone.

Carbonate of lime is sometimes found combined with carbonate of magnesia; this compounded rock, when heated, gives out its carbonic acid gas more quickly than common limestone, but attracts it from the atmosphere, and from decomposing plants much more slowly.

Caustic Magnesian Lime is superior to common Caustic Lime, as a Manure for Bog.

Mr. Professor Davy, in his late admirable course of Lectures (delivered in the Laboratory of the Dublin Society,) on the application of Chemistry to agriculture, observed, that magnesian limestone when rendered caustic, may perhaps be considered as superior to common caustic-lime as a Manure for Bogs, as its effects would be more lasting, for the reasons above stated, namely, that it requires a much longer time to become saturated with carbonic acid gas.

The mode of ascertaining whether Limestone contains any Magnesia.

The mode of ascertaining whether Limestone contains any Magnesia or not, is very simple, viz. throw a small portion of Limestone, coarsely powdered, into a glass containing dilute Muriatic Acid (spirit of Salt,) or dilute Nitrous Acid (Aqua Fortis;) if the stone contains much Magnesia a weak effervescence will take place, and a white cloud will be formed in the liquor; but if it contain none, the effervescence will be very strong, and the solution, if the Limestone be white, greyish white, or blue, will be nearly colourless; if the Limestone be black, the solution will necessarily be black, owing to the colouring matter of the stone, which, in the instance of Kilkenny Marble, contains from one half to one per cent of carbon or coaly matter.

Limestone Gravel.

Limestone Gravel.

It appears from the descriptions given in my former and present Report, that the whole of the Bogs in this District are surrounded by abrupt ridges of limestone gravel; and also from the Sections, that in every instance this substance is found immediately below a thin stratum of blue clay, which is interposed between it and the bottom of the Bogs.

The hills of limestone gravel differ materially from each other in the size of the rolled masses of limestone of which they are chiefly composed, and may be classed in the following manner, viz.

First variety.

First.—In some instances these rolled masses exceed three feet in diameter; where such occur, clay mixed with small limestone gravel, or rather limestone sand, is usually found interposed between them.

Second variety.

Second.—Extensive ridges of rolled limestone are sometimes found perfectly free from any admixture of clay or other foreign substance; in this case the rounded pebbles are nearly of an equal size, seldom exceeding three inches in diameter, and rarely less than one; these ridges have a strong resemblance to the rounded strong masses which form the edge next the land of a rocky sea-beach, and evidently had their origin from eddies formed by strong currents of water running in nearly opposite directions.

Third variety.

Third.—Hills composed of strata of limestone gravel, or rather of limestone sand, are also frequently met with; though the stratification is not perfectly regular, still the beds are very distinct from each other, and usually differ very materially both in their composition and in the size of their particles; some (particularly the upper beds) contain much clay, whilst others are perfectly free from that substance, having little or no tendency to sully clear water when thrown into it.

First variety used as manure.

These three varieties of limestone gravel are applicable to three different uses: The clay mixed with limestone gravel or limestone sand, contained in the first class, and also in the upper part of the third, has long been known as an admirable manure for the production of wheat, the Farmers in this country call it corn or manuring gravel; this substance has also been employed with signal success in the reclamation of fibrous or red Bog, of which I shall hereafter speak more at large.

Second variety used in making Roads.

The second variety of limestone gravel is used chiefly in the formation of Roads, and is admirably adapted to that purpose, but if used in forming Roads on Bog, it ought to have a sole or sub-stratum of clay and branches of trees (if they can be procured) first laid on to prevent its sinking unequally, or mixing with the upper surface of the Bog.

Third variety used in building.

The pure beds of the third variety are usually employed in building, and from their being perfectly free from clay, form, when not overcharged with lime (a caution rarely observed) perhaps the hardest mortar that we are acquainted with.

Tenacious

Tenacious or Blue Clay.

This substance is found almost universally forming the immediate sub-stratum of the Bogs in this country; it is generally perfectly free from gritty or stony particles; where they occur, it comes under the class of corn or manuring gravel.

Tenacious or Blue Clay, forms the immediate substratum of the Bogs.

Blue clay is an excellent manure for fibrous or Red Bog; it fills up the interstices, and gives compactness and solidity to the surface, and owing to its quality of retaining water, prevents this porous species of Bog from becoming too dry in summer.

It is an excellent Manure for Red Bog.

Of Turf Ashes.

This substance is divisible into three distinct species, viz.

Ashes.

White Ashes, Yellow Ashes, and Red Ashes.

White Ashes.

As a manure this kind of ashes is of little or no value, at least it has hitherto been found impossible to collect it into a sufficient body to bring its useful properties into action on a large scale.

White Ashes are of little or no value as a Manure.

Yellow Ashes.

By yellow I mean that which remains from the burning of that variety of compact or Black Bog which contains lime.

Yellow Ashes are much esteemed as a Manure both on compact Bog and upland; they will give excellent crops of rape, potatoes, oats, &c.

Yellow Ashes are much esteemed as a Manure for Black Bog.

Red Ashes.

Are considered rather superior to yellow or earthy ashes as a manure; they have however nearly similar effects in the production of crops.

The whole of the foregoing Manures may be applied beneficially to every species of Bog; but the degree of their effect will be proportionate to the capability which the Manure possesses of counteracting any injurious qualities which the Bog may contain in itself, or by adding a substance which may bring its native valuable qualities into action. I shall now therefore take into consideration the effects which these several Manures will exert on each species of Bog.

Red Ashes are also excellent on Black Bog.

Application of the foregoing Manures to the different kinds of Bog.

Manure best suited to the improvement of Red Bog.

This species of Bog when first drained is extremely porous and open in its texture, on which account it is liable to become so dry in summer, that the natural grasses which in spring had vegetated on its surface, frequently die from want of moisture; from the absence of water and by long exposure to the atmosphere, the surface of the Red Bog is decomposed; the mass is thus rendered more compact, and becomes capable of supplying food and moisture to plants in dry weather; this operation of nature, though certain, is however very tedious.

Manures suited to Red Bog.

Surface is decomposed by exposure to the Atmosphere.

I shall therefore submit to your consideration, the means we have in our power of quickening her pace, and of rendering the improvements more perfect.

That species of limestone gravel which is called corn or manuring gravel, is the most efficient Manure with which we are acquainted, for creating a rapid and lasting improvement on the surface of fibrous or red Bog.

Corn Gravel is the most efficient Manure for creating a lasting improvement on Red Bog.

Two modes of applying this substance are practised; the first, is by merely spreading gravel on the surface of the Bog when drained. Its effects are manifest; they are superior, although somewhat similar, to those ascribed to tenacious or blue clay, to which must be added the nutritive qualities of the lime contained in the gravel, which gives out its fixed air to the plants which are supplied with moisture by the clay in very dry weather, and are thereby kept alive.

First mode.

Some farmers plough or dig up the Bog, previous to spreading the gravel, and afterwards gather the whole into heaps and burn them; a very valuable and heavy kind of ashes is thus formed, which is composed partly of white ashes, partly of burned clay, and partly of caustic or quick-lime.

Second mode.

The quick-lime immediately acts on the red Bog and dissolves it, but the clay loses its tenacity by being burned, and is thereby deprived not only of its quality of retaining water, but of its tendency to remain on the surface of the Bog; the whole of the ashes having no check will naturally descend through the open fibres of the Moss, and in a few years they will have sunk so far that the surface will be deprived of their beneficial effects. If this reasoning be just, the second mode of proceeding, namely, by burning, should be deferred a few years, or until the surface of the drained Bog should have so far subsided as to become sufficiently solid to retain water, and to prevent the passage of the ashes downwards. In such

The second mode of proceeding should be deferred till the surface of the Bog has become solid.

such circumstances, the most beneficial effects might be expected from burning the surface of the Bog.

Blue Clay is a good Manure for Red Bog.

Tenacious or blue Clay, comes next in the order of valuable Manures, for the improvement of fibrous or red Bog; its effects have been already described; caustic or quick-lime might be added with great advantage in conjunction with the clay, as it would dissolve the surface of the Bog, and would be prevented from passing through the fibres of the Moss, by the tenacity of the clay.

Caustic Lime should not be used alone as a Manure on Red Bog.

For the reasons already stated, it is almost unnecessary to add, that caustic lime should not be used alone as a Manure on fibrous or red Bog, but should always be accompanied by clay or corn gravel.

No very beneficial effects can be expected from the application of Ashes alone, as a Manure on Red Bog.

No very beneficial, or at least no permanently good effects, can reasonably be expected from the application of either yellow or red ashes alone as a Manure, on the surface of a red Bog when drained, as these substances, unless accompanied by corn gravel or by clay, would almost immediately pass through the fibres of the moss and be lost.

Improvement of Quagmire.

Improvement of Quagmire.

Though this species of Bog is the wettest and least inviting of any, when in its native state, it is more easily drained, and becomes profitable with less expense than any other.

Manures, similar to those proposed for Red Bog, should be resorted to.

Shortly after the excess of water has been discharged, a thick coat of sweet grass usually springs up; if it be wished to raise crops on it, the same Manures which are proposed for the reclamation of red Bog should be resorted to, and the same precaution observed to prevent the effects of porosity on account of the open texture of this Bog.

Manures best suited to the Reclamation of Black Bog.

The principal difference which exists in an agricultural point of view, between fibrous or red Bog, and compact or black Bog, is the extreme porosity of the one, and the density of the other; their treatment must be therefore extremely different.

Yellow or Red Ashes are the best Manure for the improvement of Black Bog.
Lime used.

The Manure which has been found most efficacious on this species of Bog, is ashes produced from the burning of this substance itself; if it be wished to cultivate grass for meadow or grazing, lime is very beneficial; if the boggy soil be in fallow, the lime should be caustic; if it be intended only as surface-dressing on grass, it should be mild; if clay or limestone gravel be used, they should be gathered into heaps and burned along with the surface of the Bog, so as totally to destroy their power of retaining water, to which this species of Bog is too much disposed.

Long cultivation renders Black Bog friable.

When black or compact Bog has been long subjected to annual cultivation, it loses its compactness and becomes very friable; when this happens, limestone gravel or clay may be beneficially resorted to.

Cultivation of Bog.

I have thus endeavoured to lay before you a general description of the different species of Bog, and also of the different Manures which the country affords, pointing out, as far as the experience of others and my own observation could guide me, the particular effects which each kind of Manure might reasonably be expected to have on the different species of Bog.

Crops best suited to Bog cultivation.

I shall now lay before you some general remarks on the crops and grasses which appear to be best suited to Bog cultivation, together with a statement of the process (accompanied by an estimate of the expense thereof) which I should recommend for the complete reclamation of red Bog.

Rape.
Oats, Potatoes, and Rye.
Hemp has been tried, but did not always succeed.

Rape appears to be the most favourite crop, at least in the commencement; Oats, Potatoes and Rye, are found to answer nearly as well; the latter is, however, frequently good when other crops fail. I have seen Wheat tried on the surface of very deep red Bog; the produce was tolerably good, but the grain was not full. Hemp has been tried by many persons with various success; where failures have occurred, they are perhaps attributable more to ignorance of the mode of cultivation, and the proper method of saving and drying, than to any imperfection in the boggy soil. It is to be observed, that this plant likes a deep soil, but will not thrive in wet; unless, therefore, the Bog shall have been previously completely drained, the soil (to some depth) turned up, and exposed to the atmosphere, and intermixed with limestone gravel, there can be little hope of obtaining a valuable crop; but with these precautions the best success may be expected.

Extract from Mr. Nasmith's Essay on the Properties and Uses of Peat.

Mr. Nasmith, of Hamilton, in his Essay on the Properties and Uses of Peat, gives the following description of the several species of Grass which have been known to grow on boggy soils:

" Anthox-anthum odoratum (sweet-smelling early meadow grass or vernal grass) is found
" scattered every where on Peat-grounds where land-water has flowed; it is a valuable grass,
" palatable to the cattle, springing early, and putting forth abundance of new leaves through
" the summer.

" Alopecurus pratensis (meadow fox-tail grass) grows in similar places, and is valuable
" for Hay and Pasture.

" Poa pratensis (great meadow-grass) and Poa trivialis (common meadow-grass) are
" grasses to which a Peaty soil is highly agreeable; they propagate very fast in it; cover
" the

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“ the surface with a close Turf, and are excellent Grasses, very productive both of Hay and “ Pasture.—Cynosurus Crystulus (crested fox-tail grass) I have not unfrequently seen about “ the borders of a Peat-field; it abounds in the best pastures, and cattle are fond of it.

“ Children might be taught to know these plants, and collect the beads as soon as the “ seeds were ripe, two or three years before a field was to be sown; these seeds sown on a “ piece of well-prepared ground, each species by itself, would soon produce a stock which “ might be preserved till it was wanted.

“ Trefolium repens (white Clover) abounds much on Peat with which earth has been “ mixed; its value for Pasture is well known, and as its seeds are to be had in the shops it “ ought not to be omitted.

“ Sathyrus Pratensis (common yellow flowering vetchling, or tare everlasting) I have “ sometimes, but not frequently, seen about the borders of a Peat-field; it is valuable fod- “ der; and as it is very prolific, its seeds might easily be gathered; and trial made of it “ would succeed.

“ Lotus corniculatus (Bird's-foot trefoil, has a yellow flower like that of broom, and “ leaves with three lobes) is the only other plant of the diadelphia class, which I recollect “ abounding on Peat-grounds; it has been much extolled as food for cattle, but they seem “ not fond of it while green; it is not rejected in hay, and is perhaps eaten when other “ grasses fail; as it is congenial to a Peat-soil, and grows to a good size, it should certainly “ be adopted.

“ Trefolium pratensis (meadow fox-tail) the cow-grass of the English farmer, puts out “ many horizontal roots from the main one, and would probably keep hold of a Peat-soil; “ if it should succeed it would make a valuable fodder, and therefore merits a trial.”

Expense of Reclaiming Bog, so as to render it worth £. 1. 10*s.* per Acre.

Expense of reclaiming Bog.

In respect to the mode by which the Bogs when drained shall be brought into profit, by distributing on the surface the Manures above-mentioned, much will depend upon the relative circumstances of each particular Bog, in respect to the distance of the gravel, clay, or lime to be laid out upon it.

In some situations it may be found expedient, by placing stop-gates at the main Drains, to dam up the water, and thereby to make temporary Canals, whereupon the Manure may be conveyed on floats into central situations, and from thence, either in times of frost or after some continuation of dry weather, it may be distributed by carts or wheel-barrows upon the surface of the Bog. I understand, that Mr. Edgeworth has (in such situations) recommended the use of moveable temporary railways; and I am fully pursuaded, that if they be constructed upon a simple plan they will be found to diminish the expense, and considerably to facilitate the progress of the work: but these are only general, and perhaps obvious suggestions. The practical improver will expect closer and more distinct views of the subject, particularly in regard to the amount of the expense, and the probable return to be expected in the course of 3, 4, or 5 years, for the original out-lay; I shall therefore give what appears to me (upon the best information I have been able to obtain) a fair and candid prospectus of such an undertaking.

I should recommend, that after the several Drains suggested by me shall have been completed, that the Bog should be suffered to remain for eighteen months, or perhaps two years, to subside; during which time it will be necessary to employ a sufficient number of labourers, under the direction of a competent Overseer, to remove obstructions, and to keep the Drains in perfect repair; in estimating the Drains, I have increased the price per cubic yard to cover this expense.

This I consider to be a very important part of the system, and in very wet Bogs it will require much attention, at least for the first year.

That part of the Bog which lies nearest to the clay or gravel, will of course be brought into profit at a smaller expense than that which lies more distant, the estimate must therefore be formed upon the average expense of manuring a given number of acres; suppose a square of 400 acres, divided into twenty equal parts, by main, minor, and cross Drains, and communicating with each other, wherein the water in some instances may be occasionally dammed up by stop-gates, and the whole when necessary brought nearly upon one level as above-mentioned.

The gravel and clay may be deposited by narrow floats on the borders of the several divisions.

The first process ought to be to form roads along the edges of the Drains, sufficiently strong to bear the weight of small carts; and again I must recur to the superior advantage in this process, to be derived from the plan of wooden moveable railways.

The first object should be to form Roads.

Wooden moveable Railways would be very useful.

I am next to consider the quantity of manuring-gravel which would be sufficient to cover an acre of Bog, in order to render it capable of producing a good crop of Rape, Potatoes or Oats, or rather a succession of these three crops, without any further addition of Manure than the Ashes that would be produced by a light or partial burning of the surface. I should suppose that six loads to the perch of gravel (each load containing about seven hundred weight) would be amply sufficient to cover each acre, together with a slight top-dressing of Ashes, or (if more convenient) of quick-lime, say one thousand loads, or three hundred and fifty tons of gravel to the acre, I should calculate, that upon a general average, each load could

1000 Loads of Gravel, equal to 350 tons, are proposed to be laid on the Bog.

The Expence would be £.16. 13*s.* 4*d.* per acre.

Caustic Lime £.6.

Planting and digging, &c. an acre of Potatoes £.10.

A second Crop of Potatoes should follow the first. 3rd year a crop of Oats. 4th year Meadow.

could be laid on the Bog at an expense of about four-pence per load, or £.16. 13*s.* 4*d.* per acre, and that the top-dressing of caustic-lime would cost about £.6 per acre more, to which add the expense of planting and digging out an acre of Potatoes, £.10. I would recommend a second crop of Potatoes to follow the first, in which case the produce of the second year will be found greatly superior to that of the first; the third year a crop of Oats, and to lay down the land with Hay-seed; fourth year Meadow, without any additional expense.

The Bog would then be worth £.1. 10*s.* per acre.

If I am not greatly mistaken, the Bog so treated would be completely reclaimed, and would, in its then state, be well worth £.1. 10*s.* per acre per annum.

Another rotation of Crops.

There is another rotation of crops which I should prefer to the foregoing, and which is also frequently practised, with the exception, however, that the large quantity of clay and gravel which I have recommended, is seldom if ever afforded to the Bog in the first instance, and on which increased quantity I build my expectation of *perfect* reclamation, by forming a solid upper stratum on the Bog, without which the plough can only operate at particular seasons, and even then with danger and difficulty to the cattle.

1st Crop Rape.

2d Crop Potatoes in Drills, to be followed by Oats and Meadow.

An additional Covering of 250 Loads of Gravel proposed.

Reclaimed Bog valued at £.1. 10*s.* per acre.

After the one thousand loads of gravel as above stated shall have been laid out and spread, the whole should be lightly ploughed, and after a slight top-dressing of lime, or of red ashes, which latter may be easily produced by burning the surface of the nearest red Bog, a crop of Rape should be sown, to be succeeded with one crop of drill Potatoes, Oats and Meadow and as soon as the hay shall be mowed, about two hundred and fifty loads of gravel or clay per acre should be laid out and spread upon the surface. This process would leave the land (for such I might then call it) in a state of great power and vigour, and infinitely more profitable to the farmer for Tillage, Meadow or Pasture, than most of the uplands in the neighbourhood. I might venture to say, that after the above process, including the second top-dressing of gravel, the value of the Bog to the farmer would far exceed (but I shall state it at no more than) £.1. 10*s.* per Irish acre.

[Mr. Griffith then proceeds to various details, which are inserted in the Second Report.]

REP. II.—Mr. *Jones*, on Bogs in Meath, Westmeath, and King's county;—General observations and plan for opening drains; with a Plate.

Mr. JONES, on the Bogs in Meath, Westmeath, and King's county.

Origin and growth of Bogs.

With respect to the origin and growth of the Bogs in this Kingdom, I believe it is pretty generally known and understood, that the substance of which they are composed is vegetable matter in various stages of decomposition, resting on an under strata, in general of blue or yellow clay or gravel, and frequently of marle, the depth of which below the surface varies from ten to forty feet, and is scarcely ever regular for any great extent, as will be seen by the Sections taken for the main and transverse lines of Drainage.

Causes of wetness in Bogs

the tenacity of the matter causes the water to lie on the surface.

Bogs in general are more or less saturated with water, the cause of which is, either springs from the under strata on which they rest, or those issuing from the adjoining high lands, or from rain falling on their surface. The tenacity of the vegetable matter of which they are composed, causes the water in the latter instance to be retained on their surface, by which means vegetation is chilled, except for the warmest months in the year, when the heat of the sun absorbs a great portion of the moisture, and causes a partial growth of heath, moss, and grass, which by the winter's rain is again deadened and decomposed. A succession of the above circumstances has, I conceive, tended much to the growth of Bogs in this Kingdom from swampy marshes or stagnant pools to their present state.

Bogs in this District easily reclaimed.

Circumstanced as the Bogs are in this District, their reclamation could be much more easily effected than appears at first view, the outlets or discharging points of their waters lying in general so much below their summits, that the Drains executed as marked on the accompanying Map, would carry off all the water of the Bog so effectually, that in the course of a short time they could be rendered fit to receive agricultural improvements.

Good effects of Drainage.

The first good effect that would result from the Drainage of wet Bog, would be a general growth of heath, and grass of a peculiar sort, which vegetates spontaneously on the surface of reclaimed Bogs, and is excellent food for young cattle. As the Bogs subsided by the sinking of the Drains, cattle of every description might feed on them; so that by the expenditure of a comparatively small sum of money, the large tracts that are now in an unproductive state would become so much pasture, a great portion of the edges of which might be immediately tilled, which improvement would extend ultimately to the centre of the Bogs.

Main Drains.

Transverse Drains.

The main Drains through the Bogs are laid out (according to circumstances at about 80 perches asunder, and the transverse Drains, crossing the main Drains generally at right angles to them, are also laid out at the distance of 80 perches from each other; the principal consideration has been, to point them in such directions as to give the waters the greatest fall from the summit of the Bog, to their outlets or natural discharging points.

The main and transverse Drains through the Bogs will be found to consolidate and cause them to subside very considerably; yet for the purpose of rendering them fit to receive agricultural improvements, intermediate Drains, both between the main and transverse lines, will be indispensably necessary; these Drains to be midway between the others, and sunk five feet deep.

Intermediate, or Surface Drains necessary.

Wet Bogs will not admit of the main and transverse Drains to be sunk at once to their full depth, as the sides would have a tendency to close together, and the bottom to rise and swell up. Time, therefore, must necessarily be given for their sinking.

Wet Bogs will not admit of deep Drains being sunk at once to their depth.

The main Drains through deep and wet Bogs, I propose to be sunk from 14 to 16 feet deep, and the transverse Drains to be sunk from 10 to 12 feet deep; the whole to be two feet wide at bottom when finished.

Size of Main and Transverse Drains.

The annexed PLAN of the method to be pursued in sinking Drains in Bogs, will, I trust, be found clear and satisfactory.

The mode that I have found most eligible to adopt in executing Drains through Bogs, is to begin by first opening them (like E in the annexed Plan) viz. 4 feet wide at top, sinking them 3 feet deep, and making them one foot wide at bottom throughout their whole extent. When the Bog by this means has subsided (a foot or eighteen inches) to *a b*, which it will do in the course of a very short time, immediately adjoining the Drain, repeat the sinking by taking off one foot on each side of them, which will give sufficient room for sinking them two feet deeper. As the Bog will gradually subside to *c d*, *e f*, *g h*, *i k*, *l m*, N O, the above operation of resinking the Drains should be continued until the whole be sunk to the depth intended: it is on the above principle that I have calculated the Drains to be sunk through the Bogs in this District.

Method of working Drains in Bogs.

A, B, C, D, is the Section of a main Drain 16 feet deep, 2 feet wide at bottom, slopes of the sides 6 inches horizontal to 12 inches perpendicular. A perch (21 feet in length) of a Drain of the above Section would contain 124 cubic yards of excavation; but by sinking the Drains in the manner above described, and according to the several repeated cuttings E, F, G, H, I, K, L, M, a perch would only contain 66 cubic yards when excavated to the bottom, provided the Bog subsided in the proportion that is here amplified, which in this instance is 9 feet from the original surface to the surface which the Drains would be at when finished; they will then be nine feet wide at top and 7 feet at depth. By adopting this method, a saving is made in actual excavation of 58 cubic yards of Bog and fluid matter contained in the spaces of A P N, Q B O, which would inevitably be encountered in the instance of opening Drains to the full width at top, according to the depth to be sunk.

Saving in excavation by executing Drains in manner here proposed

In moderately firm Bogs. the saving in point of execution will not be quite so much as in the above example; but in the wet Bogs it will be found to be probably more, as the subsiding will be greater.

Saving in execution of Drains, with respect to firm and wet Bogs.

In almost all instances of draining Bogs, I conceive that the above is not only the best practical method to pursue, but also the most eligible and economical for cutting Drains; the widening and sinking the Drains being repeated as the Bog consolidates, it is evident that the sides will not have the same tendency to collapse, nor the bottom to swell up, as would be the case were the Drains to be opened to the full width requisite to sink them at once to the proposed depth.

During the operation of sinking the Drains, frequent trials should be made to give vent to the water from the bottom and under strata, by boring to it with an auger of about three or four inches in diameter. This operation is attended with very little labour, and the beneficial effects of it I have frequently observed: as, whatever springs may be at bottom, by this means will get vent, and discharge by the Drains, which would otherwise continue to saturate, and keep the Bogs afloat.

Bottom of Drains to be bored during operation of sinking.

It is by no means to be inferred that the entire surface of the Bog will subside in the same proportion as that adjoining the Drains; but this circumstance need not impede the widening and deepening of the Drains in the manner above described, as, by the time that the first sinking is performed throughout their extent, the Bog will be so much subsided at the place where first opened, that it will be in a state to admit of being proceeded on with the second cutting, and so progressively till the whole is finished.

The whole surface of Bog will not subside in same proportion as adjoining the Drains.

REP. II.—Mr. *Longfield*, on Bogs bounded on the North by the Grand Canal between Tullamore and its junction with the Shannon, called the district of the River Brisna; plans for drains, general observations, improvements, &c.

Mr. LONGFIELD, on the Bogs to the South of the Grand Canal, in that part between Tullamore and Shannon Harbour.

I have the satisfaction also to state, that I have every where found sufficient falls from the Bogs to carry off the surface waters of them, and in general it is practicable to drain the under strata, should such an expensive undertaking be ever deemed advisable. But such deep sinking in the interior of the Bogs I do not conceive absolutely requisite to effect the object of Drainage (unless you reach the under strata) from this very extraordinary circumstance, Rep. II. Mr. Longfield.

cumstance, that the vegetable matter of which the Bogs are composed, is so far from being of a porous nature, that it is perfectly retentive; of course Main Drains of even 20 feet deep and 80 perches, as under, would have no more effect upon the centre of the surface between them, than if they were only sunk to the depth recommended for Surface Drains.

This may appear improbable; but nothing can demonstrate the truth of the observation more, than simply observing, that the numerous duck-pools, and lodgments of water in the Bogs, are almost all upon different levels, whereas if there existed any internal communication, this would not be the case. Under this impression I have formed my system of Drainage to be composed of numerous Main, Receiving, and Surface Drains, of moderate dimensions. The circumstance of this extraordinary quality of the soft Bog stuff is fully proved in the Bog of Ballycotton (see Report upon the 10th Division,) where there exists two considerable bodies of water near each other, differing two feet and an half in their levels.

I have also found in many situations, good manuring gravel, sufficiently near the surface to be raised without incurring much expense or trouble; where such cases occur, I have particularly noticed them on the Map, and would recommend raising the stuff to the surface; but where the manures cannot be had nearer than from 8 to 10 feet, I would not advise any attempt to diffuse their benefits.

Every where possible, I have attended to three principal objects in laying down the situation of my Main Drains. First, to answer as Tap Drains; secondly, as occasional channels of navigation; and thirdly, when the chief object of Drainage is attained, and the Bog reduced to a state of cultivation, those drains can be finally dammed up, and the water generally diffused over the surface for purposes of irrigation. The value of water manure upon dry and parched Bogs, has been fully exemplified, to my utmost satisfaction, in the course of my late Surveys, which being commenced on the 21st of January, and finished in July, gave me an opportunity of daily witnessing the progress of vegetation in the winter, spring, and in as hot summer months as we have had in this kingdom for many years. In the month of February I observed, particularly the Fiorin grass (so highly recommended by Dr. Richardson) growing luxuriantly in many parts of the Bog Drains, and on the sides of the Roads, during a continuance of severe wet and snowy weather; and I observed the very same grass dry up and wither as the drought approached, and continued so in April, May, and June. From the 1st of April till about the 20th of June, we had a continuance of extreme hot weather, during which time there was not the least appearance of vegetation in the Bogs, and very little on the land; from that period to the middle of July we had many heavy showers, and some constant days of rain, the effect of which created almost immediate vegetation, for in the course of those few weeks, the Bogs that before presented a surface not even affording heath itself, now produced a most abundant supply of sappy and luxuriant grass, which it is to be regretted could not be grazed, the Bogs being inaccessible to cattle; for although the first 3 or 4 inches of the surface was both dry and crisp, yet if that were broken through by man or beast, it is a chance if ever they should be able to extricate themselves. If it were possible to entertain doubts of the efficacy of irrigation on drained Bogs, this single instance, I trust, will be sufficient to remove them; it is very seldom that this climate affords an opportunity of proving this fact so satisfactorily as this year; the effect of the unusual drought of this season may be presumed to have acted on the surface as effectual drainage, and the sudden fall of rain operated as an irrigation supply, which from the state of the Bogs, was as suddenly absorbed as if carried off by the most complete drainage for that purpose; by this means the Bogs were in a great measure prepared to receive the waters, and by retaining them no longer than was necessary to promote vegetation, they produced the sudden spring of grass already mentioned.

It is with pleasure I have here to observe the praise-worthy experiments made by Lord Rosse, according to Mr. Richardson's plan for cultivating the Bogs of Ireland. The portions of Bog allotted to these experiments are an acre on the Red Bog of Ballywilliams, near Parsonstown, 27 feet deep, and an acre of the Bog of Clobrone, of the same nature. The first of these experiments was prepared by levelling the Bog, and sprinkling it with a compost of lime and clay, and the grass was planted in October last. I went through it frequently in June, and saw the grass planting in many spots over the surface appearing both healthy and luxuriant; the uncommon drought of the season was much against its growth, but I have no doubt it will next year present a pleasing prospect of what may be done on those unprofitable tracts, and prove to the proprietors, the possibility of increasing their own estates on much easier terms than by purchasing the fee simple of others.

In treating of improvements upon such extensive tracts of plain surface, I conceive it to be of the highest importance to take into consideration the most efficient way of providing shelter, as it must be admitted that cold and chilling blasts, passing uninterrupted for a distance of three or four miles, or even less, must check vegetation, and be prejudicial to cattle, particularly young stock; which description it is most probable the improved grassy Bogs would be best adapted for, until their surface should become consolidated and interwoven with vegetation. To obtain this desirable acquisition, I would propose to intersect the Bogs with belts of skreen planting, in such proportions as local circumstances might render necessary, always keeping in view to break the effects of the prevalent westerly winds. The object of shelter would not only thereby be attained in a few years, but also a profitable growth of Timber of considerable magnitude, which would contribute to repay the expense of Drainage, &c.

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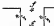
I have found the Bogs (with few exceptions) to be in a similar state of wetness. The sources from whence they are fed I shall particularize in my detailed Reports; they generally are from 20 to 40 feet deep, and the under strata are every where chequered with blue clay, gravel, and sand. Marl, in some instances, is found; but the general depths of the Bogs are such as to render the under strata of little or no importance in point of manures, as the expense of raising them would more than counterbalance the prospect of future expectation.

In the course of my Survey I have met with many spots of the Bogs perfectly dry and fit for immediate agricultural improvement, and some places where crops might be produced with little labour, and a prospect of a good return. My surprize was naturally excited on beholding such temptations held out by Nature, and that to a people apparently industrious. I of course inquired into the cause of such apparent and palpable neglect to their own interest, but was soon perfectly satisfied, that the want of title, and the dread of being obliged to pay for their own improvements, was a sufficient reason why those Bogs passed from father to son in the same state of nature in which they had been found many ages past. Thus the want of title, and the fear of accumulating rent, prevents the smallest spirit for improvement; whereas, if even a small portion of those uncultivated tracts were leased at a reasonable value, the spirit of emulation would instantly manifest itself amongst the tenantry: the landlord would receive rent for what now remains almost useless to the tenant, and a blank in his rent-roll, and the tenants would then chearfully improve and convert unprofitable Bogs to useful and agricultural purposes.

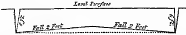
On the subject of Drains in general, various are the opinions likely to be given by the number of persons who have now that subject under consideration; for my own part, I have made up my mind and drawn my conclusion, from the Drainage already effected on different parts of the District committed to my charge, and upon the existing circumstances of the undrained tracts, which are particularly given in my detailed Reports. My Main Drains in general are laid out with from 10 to 15 feet sinking; the surface Drains which I have met with are four or five feet deep, six feet wide at top, and one foot at bottom. I would however recommend perpendicular surface Drains four feet wide and four feet deep, thus.



My reason for recommending this description of Drain, is, that I have found them to stand remarkably well, even where they have been seven feet deep, and but four feet wide, and which may be viewed any day in the Red Bog of Lettybrook. These descriptions of surface Drains are easily passed over, and they are not liable to be choaked up by sods thrown in by every passenger who thinks proper to make short cuts across those tracts. There is also another advantage in the four-feet Drains, namely, that Bog bridges formed on them are likely to stand much longer than if they were across a six-foot drain. These bridges I find to answer all the purposes of communication; and they are adopted in many places, particularly in Mr. Berry's Bog improvements at Clooneen and Galros. They are formed in the progress of making the Drains, by leaving five or six feet of the Drain uncut at proper places, through which a passage for the water is perforated, and the surface gravelled. I would therefore recommend the general adoption of those bridges on all the surface Drains, at a distance of not more than 15 or 20 perches asunder, besides one at the junction of every surface Drain with its main carrier. This great and necessary accommodation can be done without any additional expense in making the Drains.

It may seem strange to a person unacquainted with the facts, that perpendicular or walled Drains should be recommended, under an impression that the soft quagmire of which most of the Bogs are composed would collapse or close together; the fact is quite the contrary, for the sides (being perpendicular) will not retain or catch the waters falling on the surface, but will in consequence harden and become in fact a Bog wall, supported and kept together by its unbroken fibres and ties from top to bottom; whereas sloped Drains, by exposing to the weather all their broken sides, are kept continually in nearly their original state of wetness. However, it would not be safe to recommend this system for the larger description of main and tap Drains, as in the event of man or beast falling into them, it would be almost impossible to save themselves from perishing.

The surface Drains marked on the Map are laid out generally to form acute angles with the main Drains, so as to embrace the greatest fall of the natural declination, by running obliquely along the inclined plane. Where no advantage can be had by this means, and where the whole surface forms a dead level, an artificial fall must be substituted—thus



On the important subject of Manures, and the practicability of raising them from the under strata, or conveying them from the periphery into the interior of those immense tracts of Bog, much might be said; I shall however confine myself to briefly stating, what I conceive to be the most probable and effectual method of carrying into execution that most desirable object.

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The different Lines of Drainage which I have the honour to submit for your consideration, will, I trust, be sufficient to reduce the surface to a state of consolidation; but we must not stop there; spontaneous vegetation cannot possibly find its way into those dreary wastes for ages, and therefore the aid of manures is indispensibly necessary. In the Black Bog and Moors, the loss of compost or manuring gravels is not so severely felt, that description producing strong ashes, by which the landholders are enabled to propagate profitable crops of rape and potatoes, &c. But as this species of manure is unattainable in the shaking Red Bogs, methods must be devised either to raise the under strata to the surface, or to convey from the exterior such gravels or manures as the surrounding country affords. This last resource, with a few exceptions, is in my opinion the most practicable, and even this cannot be carried into effect without great labour and expense. However, the magnitude of the undertaking, and the benefits likely to result from it, have induced me to take advantage of the natural capability of the country in affording means of conveying manuring gravels to the interior of the Bogs by the aid of navigable cuts, and therefore wherever gravel may be had with a supply of water to command the summit of a Bog, I have, in laying out my Main Drains, kept in view the further object of converting them into future lines of navigation for Bog purposes only; when I say for Bog purposes only, it is necessary to observe, that those proposed Cuts, being formed on different and promiscuous levels (depending on the supply of water and gravel) they cannot be converted into any general line of Canal for purposes of trade (the want of which is already supplied in this District by the present line of the Grand Canal from Tullamore to the Shannon) and therefore they are proposed to be only such as would be capable of passing manure and gravel boats of from 15 to 20 tons burthen, in consequence of which they need not be finished on a large or expensive scale.

The Bog stuff raised in excavating the navigable Drains could be converted to profitable purposes; it might be brought to the Bog edges in the boats returning for a supply of gravel, &c. and drawn from thence upon the uplands. I have seen the best crops in the country produced on light gravelly soils by this means only; and I am assured by gentlemen of respectability, that this species of manure is so valuable and certain in its effects, that it is generally used upon the uplands, not only bordering the Bogs, but frequently at a distance of half a mile or more, until the drawing of it becomes more expensive than the return would compensate for. The value of Bog stuff is further exemplified in the interior of the country, by the care with which the turf mould at the bottom of the ricks is collected and spread upon the land with a small portion of lime or clay mixed with it. This compost is even used with success in rearing garden stuff, such as cabbages, carrots, parsnips, &c. &c. and I am convinced that if the inhabitants of the country were induced, when going for the Bog stuff, to bring a load of gravel with them, they might thereby have reclaimed many hundred acres round the verge of these Bogs, which being immediately adjoining the natural taps of the country, did not require a preparation of expensive Drainage.

The erection of Locks on those deep Bogs is, in my opinion, entirely out of the question. Where it is necessary to convey the manure from a higher to a lower level, we must be content with landing-places in proper situations, by means of which a load of gravel may be transferred from the boat on the high level to the boat in the low one, which in most cases will not be found necessary, as either levels will generally commence or terminate in manuring gravels. By this means manures can be diffused over the surface at a comparative reasonable expense, when compared with that of horse work.

The quantity of surface which may thus be brought into cultivation will be great; for supposing that the operations of men with wheelbarrows, &c. cannot be extended more than forty perches from the verge of the Canal on both sides, yet the quantity brought into improvement will be 160 Irish plantation acres, equal to 240 English acres in every Irish mile of navigation; the fee of which 160 acres, at the reasonable rate of 30 shillings per acre, at 5 per cent. would amount to £. 4,800. On the presumption that the effects of the navigable Drains were confined to within 40 perches on both sides, but which can never be the case, when it is considered that their influence combined with the Surface Drains must extend much further, by means of which the gravel can be conveyed by cattle either by back loads or on sleds drawn over the pastures already formed, by the labour of men only. So that admitting the reclaiming of those unprofitable tracts was to cost even £. 20 per acre, there would remain a profit of £. 10 per acre to the improver, without taking into calculation the advantages of such improvement to the nation in general, whereby many hundred thousand acres of these almost useless plains may be reduced to pastures, thus enabling the Grazier to turn to tillage the uplands now occupied as feeding grounds.

The conveyance of gravel by Canal Drains, as recommended, is the only effectual way by which manures can be generally extended over the surface; the dimensions of them are proposed to be 14 feet at bottom, and to contain 4 feet water; the boats, as before mentioned, should be flat-bottomed, and calculated to contain from 15 to 20 tons; they would be then easily removed from place to place by one or two men. A navigation of this size, where no great surge of water would be occasioned to injure the sides, would keep in repair a considerable time; the advantages of which I calculate to outbalance any other mode whatsoever to facilitate the object, and save expense.

Roads are the only substitute that can be adopted instead of navigable Drains; the quantity of materials requisite to make them is immense, and when accomplished with great labour, they would afford but an uncertain passage, owing to the number of deep sloughs, cushes, &c. &c. through which they must be carried. Every day they would be getting

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worse and worse, and particularly in the winter season, when they would be most requisite (labour being then easier obtained than in summer,) and after being accomplished at a heavy expense, it would be impossible to keep them in repair for more than one or two seasons during the progress of drawing gravel to the Bogs. However, their adoption in some situations is unavoidable, and therefore I have in many cases opened the communication by Roads, where a supply for a navigation was unattainable, or where it could not be effected at a moderate expense. The navigable Drains I propose are quite the contrary, and I recommend their adoption, wherever practicable or prudent, as the best and most efficient mode to reclaim those great masses of Bog. It will be necessary to make some lines of Roads from the navigable Drains to the higher parts of the Bogs; where the levels could not be conveniently carried, those collateral roads will not be required until the Bogs are prepared by Drainage, and the navigable lines opened; their completion can then be easier effected, having water carriage for the stones and gravel to their respective points of commencement. There may be occasion for a few Bridges over the navigable Drains, which can be made of Bog timber; all other passages over the Main Drains may be reserved by only perforating the bottom and leaving the surface untouched, as already alluded to in the small Surface Drains.

On the important subject of Fuel, it is really strange that apprehensions should be entertained of its diminution in the event of Drainage, and the introduction of Agriculture on the Bogs of Ireland; for it must be plain to persons of the least discernment, that the effect will be quite the contrary, and that the practicability of forming turf banks and getting at the best fuel will be increased beyond the powers of calculation; for, instead of being confined to the verges and periphery of the Bogs, the turf banks may then be formed (if necessary) in any part of the great flow, without danger of being inundated by the surface waters or the springs which now constantly prevent access to the best part of the turbary; and further, that the interior of the Bogs which now produce the very worst and lightest kind of turf, will from the effects of the Drains be reduced to such a state of consolidation, that it will in a few years afford a superior description of that necessary article. The cut-out Bogs and Moors will also be materially benefited by the proposed Drains, and the necessary taps brought up through them will also enable the turf-cutter to open again his deserted banks, which from being under water, he was forced to abandon; thus, being enabled to reach the bottom, he can (without annoyance from springs) raise his under strata, and pursue his agricultural improvements with a certain hope of a competent return for his labours.

In the course of my Reports I shall endeavour to elucidate the important subject committed to my charge. How far I shall succeed will remain for you, Gentlemen, to decide. I hope, however, to make myself understood in representing the general Topography of the District, and the various circumstances connected with and attendant on an improvement of such great national advantage; to the result of which, and as a conclusion to those general observations, I shall now beg leave to draw your attention. The effect of Drainage, and the aid of such manures as the surrounding country and under strata afford, assisted by the Skreen Planting I have recommended, will, I have every reason to think, produce upon the deep Red Bogs a good skin of grasses, particularly the Fiorin Grass, so highly recommended by Dr. Richardson.

The shallow Red Bogs, and the Black Bogs and Moors (of which there is a considerable quantity) would all be immediately brought into a state of agriculture; the chief crops to be expected, previous to laying them down for meadow and pastures, are Hemp, Rape, Potatoes and Oats, all of which would be produced in abundance.

I am induced again to repeat and recommend the importance and value of Skreen Plantations, as before adverted to; these Plantations should form the great divisions of the Red Bogs, and be at least 4 or 5 perches wide. On the ditches of the Black Bogs and Moors, planting cannot be too generally adopted, for which purpose all the ditches should be double, and at least 10 feet wide at top, so as to admit of two rows of trees.

The description of trees which I have observed to thrive best on Bogs are Fir, Deals, Alders, Birch, Sally, &c. &c. a good specimen of which may be seen at the Earl of Charleville's, Mr. Curtis's, &c.

The general observations I have the honour to submit for your consideration in the foregoing sheets, will, I trust, be found to contain matter not uninteresting to the subject of inquiry. The important circumstances attending so general and extensive an investigation, opens a wide field for professional research. I have therefore most minutely investigated the District committed to my charge, and what I have submitted you will find to be the result of a close application to the object. I have adduced nothing but plain matter of fact, without any visionary ideas whatever; and I hope it will be found, that where I have recommended improvements not heretofore conceived practicable, they are not founded upon the origin of my own imagination, but are grounded on the more solid basis of the proved experience of others; it might be expected that I should enter generally into a discussion of the causes of those extensive tracts of Bogs, and proceed to account for their origin, as also to analyze their properties; but, Gentlemen, I must confess that such an inquiry appears to me quite irrelevant to the ultimate object. The plain matter of fact is, that we find those immense tracts in an unprofitable state of nature, and our endeavours are directed to reclaim and improve them by the most efficient ways; indeed, to enter into the subject of analyzation would not only require considerable time and experiment, but would materially draw my attention from the more important objects of inquiry; I shall therefore dismiss the subject from

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from my thoughts, and proceed to treat particularly on the present state of the respective Bogs, and recommend such improvements as appear to me best adapted to accomplish the great object of cultivating this portion of the Bogs of Ireland.

The advancement of agricultural benefits must be admitted of high importance to mankind in general; but without health to enjoy the blessings of Providence we would find ourselves miserable in the midst of abundance. Hence we must not omit to keep in recollection, that independent of agricultural improvement, the draining the Bogs and Morasses of Ireland would in a material degree contribute to improve the climate, an object of no small importance to the health of the nation.

REP. II.—Mr. *Townsend*, on the Bogs in King's County, Westmeath and Longford, between the Inny and the Brisna, bounded on the west by the Shannon; general observations, legislative views, &c.

Mr. TOWNSEND, on the Bogs to the north of the Grand Canal, between Tullamore and the Shannon.

THE main Drain being intended as a Canal for the general advantage of the country, as well as for the particular use of the Bogs, the Locks upon it cannot so readily be dispensed with; however, the entire expense in those cases should not be considered as belonging exclusively to the Bog improvements.

Where the navigable Drains, which are intended to connect the Bogs, unavoidably pass through tillage and pasture grounds, the excavation will generally be in limestone, gravel, or clay; I therefore propose to lay out those parts to the depth of six feet sinking and upwards, so that the entire quantity which may be dug out, can be taken by boats during the progress of the work, to assist in improving the Bogs, instead of wheeling it out on each side, or making banks, except where embankments may be necessary to cross any of the small rivers: this mode of bringing gravel into the Bogs will not be much more expensive than getting it from any of the surrounding hills, and thus by degrees the communication between one Bog and another will be effected without adding to the expense of cultivation.

The marl and gravel underneath the Bog or Peat would not in general pay for the expense of off-baring and clearing it of water in the deep Bog, and it would be too inconvenient and expensive to carry it from the shallow parts in sufficient quantities for the cultivation of extensive tracts, and the small Islands or Derries should be preserved entire for erecting houses upon them; recourse must therefore be had to the adjoining lands, where a greater variety, if not better manures, are to be met with.

The navigable Drainage will for ever afford a cheap and permanent conveyance to and from every portion of Bog, both for the present and future improvements; will also supply the entire surface with water for agricultural purposes; will drain the Bog effectually; and enable the farmer to carry, at a cheap rate, the produce of this new cultivation, on the Canals, into remote districts of the country, that stand in need of supplies of corn, &c. &c.

The system of Drainage which I humbly submit to the consideration of the Commissioners, will answer all descriptions of Bog, whether deep or shallow, the depth of the Bog or Peat is of no consequence in determining where they are to be made, as they are intended to suit the level of the surface; nor do I conceive it at all necessary to sink the Drains to the full depth of the Bog, with an intention of drawing or tapping the water from it, because (excepting a few feet near the surface) the great mass of Bog or Peat is a substance which is impervious to water; in some cases, where it is all hard black Peat, I have seen the turf-cutters sink from the surface to the gravel, without being in the least incommoded with water; and some of the pits which were not entirely sunk to the gravel, have remained perfectly dry for many weeks or months, if the rain water did not fall into them.

There are layers or strata of this description, more or less, in every Bog; and I am decidedly of opinion, that the springs under the Bog do not penetrate upwards through this substance, except where there are clefts or openings, but that the wetness of the Bogs is caused by the rain water, &c. falling on the surface, and lodging in the small cracks and indentures; and in the spongy texture of the surface, moss and other vegetation, which varies in depth according to its nature and quality, these retain the rain water until it is exhaled by the atmosphere, or slowly drained by the natural descent of the surface.

The deciduous parts of the annual vegetation, decayed fibres, &c. &c. adds to the mass of Peat, and perhaps in its decomposition affords nutriment (together with the rain water) to the next succeeding growth.

That description of moss which retains most rain water, has the quickest growth; hence we often find the softest parts of the Bogs in the most elevated places, and in many instances even higher than the surrounding lands; and, on the contrary, hard firm Bog on the lowest levels, which I think is a convincing proof that springs or rivers are not a principal cause of the fluidity of Bogs, but rather that they do not ascend into it at all.

As a further corroboration, it frequently happens that considerable tracts of Bog have their case much above the level of the natural outlets; so that it is probable any springs which may be underneath the peat, would percolate through the sand or other porous strata, or the interstices of rock, until it vented into the adjacent rivers.

In other cases several springs may unite, and form subterraneous small streams between the Peat and the substratum on which it rests, and in this manner they are conveyed along to a natural issue.

The continual action of air and water along these small passages, may by degrees have undermined a few places where the Peat is least fibrous or pulpy, and increasing gradually until the cavity is so large that the superincumbent weight gives way to the surface, forms the gullies or swallow holes that are to be met with in various parts of the Bogs.

After rains there are small streams formed on the Bogs, which, in pursuing their course, sometimes sink and re-appear many perches distant. This is a further instance of the staunchness of peat; because these subterraneous rivers do not always pass through to the gravel, as the water would then get a vent, and totally disappear if the substratum was of an open or porous nature; they are a kind of small tunnels perforated to a certain extent, but wholly within the mass or body of Peat; the water being thus conveyed as it were through a cylinder of Bog, discharges the same quantity at the lower end that entered in at the upper; whereas if the great body of Bog partook of the nature of sponge, the stream could not be traced to where it re-appears, as it would be diffused through and lost in the mass of peat.

It may be inferred from these premises, that small Drains, with levelling and trimming the surface, will completely answer all the purposes of drainage; and the immense saving of expense, time and risk in execution, together with the advantages to be gained by preventing obstruction and inconvenience to the general intercourse and communication, will make them preferable, beyond comparison, to deep ones; but as it is necessary to combine the mode of cultivation with the plan of drainage, to accomplish an effectual improvement of Bog, it is highly expedient that they should all be navigable, to answer every purpose.

Annexed is an Estimate of all the Drains within the Bogs, exclusive of the connecting Drains in the grounds between them, as the gravel from those parts is intended to be brought in to assist in cultivation, as before mentioned.

The total amount of the expense of a navigable Drainage, £.63,435. 7. 1½.; the quantity of Bog, exclusive of Derries or Islands, 21,075 acres 1 rood 8 perches, Irish; which makes the average expense £.3. 0. 2. per acre.

The expense of Locks Bridges and Culverts on the main Drains, with inclined planes on the collateral Cuts, and forming a junction both with the Grand Canal and the River Shannon, amounts to £.18,530, which will make an average of 17*s.* 7*d.* per acre, on 21,087 acres 1 rood 34 perches.

If Locks were to be built on the collateral Cuts, instead of inclined planes, they would add to the above sum £.8,000, of which £.3,300 is on Ballymaglavey Bog, making an average of 7*s.* 7*d.* per acre.

On the mode of culture which may be best adopted for reclaiming and improving the Bogs, there are variety of opinions; it is a subject on which I with diffidence offer any remarks; the cheapest mode, and that which will quickest turn to profit, I should suppose will have the preference.

The great objects apparently necessary are to destroy the vegetative power of the moss, heath, &c. and to procure proper manures for creating vegetation of a more beneficial and useful quality, on the easiest terms.

Draining will check the progress, but not entirely destroy the heath, moss, &c. without its being also dug to a certain depth; and when once the surface is turned over, it is usual to burn the top sod, to produce a manure; a repetition of this mode will in time have the desired effect in annihilating the moss, &c. but the crops will be light compared with good arable land, and if the process is discontinued and no further aid procured, it will then remain in a state similar to cut-away Bog.

Where the cultivation on a soft red Bog is partially done, practised only for a few years, and finally neglected, previous to the fibres of the growing moss being totally decayed, it will revive and force its way through the weak and tender grass, so that in a few years more the Bog will resume nearly its original state and appearance, particularly if the small Drains are not kept open. I have observed this to be the case with several small patches that have been taken in and let out again.

Another way of destroying the moss, &c. is to lay on a covering of manuring, or limestone gravel, after the surface is levelled and trimmed sufficient to keep the moss under until the fibres are decayed; this mode will also materially assist in keeping the Bog dry, because the weight will in a slight measure compress the spongy surface, so that it will not soak the water with the same facility; add to which the gravel will cement, and prevent much of the rain water from penetrating, by warding it off and discharging it into the Drains.

Some persons imagine that gravel will sink through the Bog; however, the idea does not seem to be altogether well founded, for we see Roads over Bogs that require little more repairs, if kept dry, than the ordinary stint of any other roads; whereas if the gravel sunk in the manner supposed, these roads could not be made passable, or would require a continual accession of gravel to keep them in order; this does not seem necessary even where there is an

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an incessant rolling of carriages, cars, &c. in very old roads, that have been a long time deserted, the gravel still remains on the surface, and the moss, &c. has given way to a beautiful verdure, although the gravel, probably, was not nicely selected.

The gravel will be a lasting aid to the new vegetation; will also give proper stamina to the Bog for the growth of timber of every description (in fact, it appears that timber cannot be matured without it on Bogs;) every repetition, if spread equally on the surface, will add to the firmness of the Bogs and luxuriance of the crops, and the Farmer will be repaid, for his expense and trouble, from the renovation of the soil.

The whole of this District abounds in limestone gravel, very fit for manuring and fertilizing the Bogs; and the navigable Drains herein proposed, will afford the easiest conveyance possible. They are in many instances directed to the foot of a steep gravel hill of from 50 to 80 feet feet in height, and of an inferior quality of ground, in order that a sufficiency may be procured with the least injury to the adjoining lands that the nature of the business will admit of; one acre of a gravel hill 50 feet in height, will cover 600 acres of Bog one inch thick, and so in proportion.

Taking the gravel hills at an average of only 30 feet in height, which is a low calculation, the one acre will cover 360 acres of Bog, one inch thick; and supposing the broken ground to be afterwards totally useless, the purchase of an acre, I think could not exceed £.36, this will amount to two shillings per acre, on the surface of the Bog, for damages to the grounds from whence the limestone gravel is to be procured.

The plan which I beg leave to recommend for bringing the gravel into the Bogs is, to have flat-bottomed boats with a platform even with the gunwale, and a double railway upon it, calculated for two rows of waggons or carriages, to be constructed for the purpose, and over this, if necessary, another platform may be erected with a single railway upon it, leaving sufficient headway for the lower tier.

A short cast-iron railway to be laid on the ground, between the gravel hill and the boat, for the waggons to run on, and when as many are placed upon the boat as the railway on the platform will contain, two men will take the boat along the Drains into the Bog, and there to have another railway not exceeding 40 perches (280 yards,) to run the waggons from the boat to any part of the surface, then to fill them and return with them emptied, and soon as they are all replaced on the boat, to return with it to the gravel hill, and repeat their operations.

I am also of opinion, that cast-iron railways and waggons could be very advantageously used along the exterior edges of the Bog, where gravel hills are convenient, and also in the small detached Bogs and places that cannot be accommodated with a navigable Drainage and boats.

The facility with which gravel can at any time be brought in by boats, renders it unnecessary to lay on more in the first instance than is really required to produce one crop; then to go on progressively, increasing the quantity with each succeeding crop, until the Bogs are gravelled completely to any thickness; and they will become profitable from the first commencement of the business, instead of having to wait for the full quota of gravel before the crops are put down, and will not require so large a sum to be laid out on the first onset.

I have calculated for one inch only of gravel, as being sufficient to produce a succession of crops, but not for a permanency; the quantity per acre will be nearly 218 cubic yards, and at the rate of sixpence per yard, for excavating and removing by boats, will amount to £.5. 9. 0. per acre.

The value of the Bog, when drained and gravelled, providing it be properly done, will be nearly equal to the adjoining lands, and these in general may be averaged at upwards of two guineas per acre per annum; the Bogs therefore, when improved in the manner before-mentioned, with the advantages also of a canal conveyance to every part, I think may fairly be estimated worth thirty shillings per acre, yearly value, at the least.

The aggregate expense of draining and improving all the Bogs in this district, including navigable Drains, and opening a communication with the neighbouring country, will be as follows; viz.

	£.	s.	d.	
The navigable Drains - - - - - -	3	0	2	
Masonry on D° with inclined planes on the collateral Cuts,	0	17	7	
Gravelling on the Bogs one inch deep - - -	5	9	0	
Damages to lands - - - - - - -	0	2	0	
	£.9	8	9	per Irish acre,
Which is equal to - - - - - - -	£.5	16	5½	per English acre.

When once the Drains are made in the manner before-mentioned, any future improvements on extensive tracts of Bog, can be done much cheaper than by any other plan; and those persons who undertake to reclaim and cultivate them, may very well afford to pay, by an acreable rent, for the convenience of navigation, from which they will receive so much benefit.

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The country will also derive great advantages from this extension of Canals, and ought to contribute towards it by a small toll upon such articles as may be conveyed upon it, that are not immediately connected with the cultivation of the Bogs.

Without a general union of interests, either by consent of parties or under the authority of an Act of Parliament, with a Board to conduct the execution of it, the scheme could not be carried into effect by the Proprietors of Estates adjoining, with any prospect of success or remuneration, as in many instances the property is undivided; some might be willing, and others unwilling or unable, to engage in such speculations; the grounds which might have great extent of Bogs attached to them, could not furnish the proper manures; others again who have little or even no Bogs, may have abundance of manures; those who might be disposed to improve, could not make the proper drains, roads or other conveniences, unless the next proprietor would also extend them through another estate.

In some cases the peculiar tenure of the estates may prevent the present possessors from laying out money on such improvements, or even to give encouragement to others by offering proper assistance and leases for a long term of years, and numerous other obstacles which cannot be foreseen might occur, so as to render a partial attempt at improvement unsuccessful; and until there have been a number of beneficial experiments made, very few individuals will run the risk of encountering the difficulty, although there can be no doubt of the result answering the most sanguine expectations.

Gentlemen,
I have the honour to be,
Your most obedient and humble Servant,
Thomas Townsend.

Balna Craig,
26 February 1811.

REP. II.—Mr. *Edgeworth*, on the Bogs surrounding Edgeworth town, bounded on the north by the Camlin and on the south by the Inny; general view of the subject; analyses, &c.; wonderful convulsion of the Bog of Rhine, &c.; Mr. Edgeworth's machines for unloading boats, taking sections of rivers, portable railways, with his description and application of the same.

Mr. Edgeworth, on the District surrounding Edgeworth town.

First view of the Project.

WHEN I undertook the Survey of District No. 7, under the Commissioners for the improvement of the Bogs of Ireland, I had no very sanguine hopes that the result would enable me to recommend to the Board any extensive measure for their consideration. I mentioned my doubts to some of its members, who encouraged me by the reasonable motive of being able, at no great expense, to satisfy the Board and the Public decidedly either in favour of the project, or to adduce such facts and arguments as would put the scheme, as to this District, completely out of their view for ever.

Unfavourable reports concerning the Project.

I have been taught, by the common reports current in the country, that the greatest part of the Bogs on the borders of the Inny were lower than the surface of that River. I had been assured that the River itself flowed upon Bog of a depth that had hitherto been unfathomable; that various attempts had been made by the owners of these Bogs to drain and reclaim them; and that all their attempts had been totally abortive.

Prejudices against the Project soon removed.

It gives me great satisfaction, however, to have it in my power to contradict these opinions; and I am happy in being enabled to assure the Board, that the experience of every succeeding week has at once strengthened my hopes and increased my belief in the practicability of making these Bogs useful land.

I had feared that a prejudice which prevailed against the scheme of reclaiming large tracts of Bog would embarrass my proceedings; but this prejudice soon vanished when the people were informed of the real intentions of the Commissioners; and when they were assured, that such Bog as could be necessary for Turbary would not be meddled with in any other manner than to assist in making it better for fuel.

General Survey and Map.

This District forms a considerable part of a large circular bason, surrounded by hills, that rise in the counties of Leitrim, Longford, Cavan, Westmeath, and Roscommon: it is probable, that these hills and the vallies between them, were covered formerly with trees; and from the remains and exuviæ of these Woods, the Bogs, which at present exist, have gradually been formed, fresh vegetation addding to the original morass.

Whether these morasses were at first formed by the destruction of whole forests, or merely by the stagnation of water in places where its current was choked by the fall of a few trees, and by accumulations of branches and leaves, carried down from the surrounding hills, is a question that cannot now be determined.

Professor Davy is of opinion, that in many places where forests had grown undisturbed, the trees on the outside of the woods grew stronger than the rest, from their exposure to the air and sun; and that when mankind attempted to establish themselves near these forests, they cut down the large trees on their borders, which opened the internal part, where the trees were weak and slender, to the influence of the wind, which as is commonly to be seen in such circumstances, had immediate power to sweep down the whole of the internal part of the forest. The large timber obstructed the passage of vegetable recrement, and of earth

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earth falling toward the rivers; the weak timber in the internal part of the forest, after it had fallen, soon decayed, and became the food of future vegetation.

Mr. Kirwan observes, that wherever trees are found in Bogs, though the wood may be perfectly sound, the bark of the timber has uniformly disappeared, and the decomposition of this bark forms a considerable part of the nutritive substance of Morasses; notwithstanding this circumstance, Tannin is not to be obtained in analysing Bogs; their antiseptic quality is however indisputable, for animal and vegetable substances are frequently found at a great depth in Bogs, without their seeming to have suffered any decay; those substances cannot have been deposited in them at a very remote period, because their form and texture is such as were common a few centuries ago.

In 1786 there were found, seventeen feet below the surface of a Bog in my district, a woollen coat of coarse but even net-work, exactly in the form of what is now called a *Spencer*. It fitted me as well as if it had been made by a modern tailor. A razor, with a wooden handle, some iron heads of arrows, and large wooden bowls, some only half made, were also found, with the remains of turning tools; these were obviously the wreck of a workshop which was probably situate on the borders of a forest.—The Coat was presented by me to the Antiquarian Society.—These circumstances countenance the supposition that the encroachments of men upon forests destroyed the first barriers against the force of the wind, and that afterwards, according to Professor Davy's suggestion, the trees of weaker growth, which had not room to expand, or air and sunshine to promote their increase, soon gave way to the elements.

Whatever may have been the cause of these Bogs, their texture is in this District very uniform.—The Bog becoming of course denser in proportion to its depth, and the colour and quality of its ashes becoming different at different depths.—With us, I have found but little manure in any Ashes, except in such as are yellow; Professor Davy informs me that there is a species of white Ashes, containing gypsum, which may be found in Peat-moss, and that these Ashes are of great value to the farmer.

The sub-stratum of the whole of District No. 7, is calcareous in the form of Limestone, Limestone gravel, blue marly Clay, and very pure Marl.

The component parts of the blue Limestone Clay that is found under the Bog near the Inny are as follow; (this bed of Clay is more than ten feet thick next the banks of that River):—

	Gr.		
Carbonate of Lime - - - - - -	44	4	100 Grains.
Carbonate of Magnesia - - - - -	1	4	
Alumine - - - - - - - -	27	2	
Silex - - - - - - - - -	27	0	
	100		

White Marl found under the Bog near the Inny, opposite Cooline, in a bed extending under the River, and in most places above Ten feet thick;

	Gr.		
Carbonate of Lime - - - - - -	87	3	100 Grains.
Vegetable matter, or Bog-stuff - - -	10	7	
Alumine - - - - - - - -	1	0	
Silex - - - - - - - - -	0	9	
Oxyd of Iron - - - - - - -	0	1	
	100		

Blue Clay found under the Bog near the Shannon, in a stratum of about 3 feet in thickness;

	Gr.		
Carbonate of Lime - - - - - -	53	0	100 Grains.
Alumine - - - - - - - -	36	0	
Silex - - - - - - - - -	11	0	
	100		

The Limestone-gravel has the plainest indications of having been fragments of Rock reduced to the globular form of pebbles by the motion of water; and in the greatest part of them, the marly Clay had probably been superinduced over the Rock and Gravel before the formation of the Bogs. Its softness arises from its having been long covered with water, which by the intervention of small pebbles had mixed itself with the Clay, and had rendered it easily plastic; depositions from the recrements of Vegetables have no doubt been added. To enter into a chemical analysis of the small portions of these different substances seems foreign to my present purpose, which is to give such practical and practicable means as may be made use of to bring the Bogs of this District into immediate and profitable cultivation. It is sufficient to point out, that the form of the Country, and the situation of its Rivers, gives us reason to suppose, that the formation of its Bogs has arisen from the accidental obstructions of those channels by which any animal substances are carried to the Ocean.

Convulsion of the Earth at Rine.

There is nothing further remarkable on the River Camlin, except the effects of an extraordinary convulsion of the Bog of Rine (or Killoe) which took place near the Bridge of Rine. In the night of the 16th December 1809, during a thunder-storm, about 20 acres of the Bog burst asunder in numerous places, leaving chasms of many perches in length, and of various breadths, from ten feet to three inches; the rifts were in general parallel to the River, but in some places the smaller rifts were at right angles to it; not only the Bog, but the bed of the River was forced upward; the boggy bottom filling up the channel of the River, and rising three or four feet above its former banks: in a few hours one hundred and seventy acres of land were by these means overflowed, and they continued in that state for many months, till the bed of the River was cleared by much labour and at considerable expense.

I repaired to the spot shortly after the event, and I examined it with great care, without being able to assign an adequate cause for what had happened.

As the Bog of Rine lies in my District, I thought proper to bestow some pains in ascertaining all the circumstances of this phenomenon. I took the levels of the Bog to discover whether it had sunk partially in any considerable degree.

I bored it in a great number of places, to make myself acquainted with the texture of the Bog, and with the nature of the sub-strata on which it lies, and to discover whether any large chasm or cavern could be found, into which the water of the Bog might have sunk; for the Bog, which had been uncommonly wet, soon became drier than any other Bog in the country. The water, however, which was found in all the rifts at three feet from the surface, continued to remain at that depth with little variation; and even since a passage has been opened, and that all the flooded meadows have become dry, the water still remains in the bottom of the chasms.

Causes of the Convulsion in the Bog of Rine conjectured.

Various causes have been assigned for this phenomenon; the most obvious is that the Bog had been undermined by rains, or by the swelling of the River, or by water descending under the Bog from the neighbouring rising grounds, and that in consequence the whole Bog slid toward the River, breaking into chasms or rifts from the resistance which it met with in passing over hard and irregular ground at the bottom of the Bog; it was also suggested that a large chasm had been suddenly formed underneath the Bog, by the falling in of a subterranean vault, and that this chasm had swallowed part of the Bog, and had, by the undulation occasioned in its fall, forced up the bottom of the River, and broke the Bog into the rifts which appear upon its surface; but no such chasms or cavern could be discovered, and the Bog had not sunk in any particular place.

To account for this phenomenon, other persons suppose that there had been a slight shock of an earthquake; this idea generally prevailed among the people on the spot, and this opinion is not contrary to experience; partial earthquakes have occurred in various parts of the world, which have happened at the same time that violent earthquakes or eruptions of volcanoes took place at great distances.

Conjectures on the causes of this Phenomenon.

As for instance, in England, in 1755, a pond in the Town of Luton in Bedfordshire, in which there had been but little water for some weeks, suddenly filled, and a copious sediment was thrown up from the bottom at the precise time of the earthquake at Lisbon, the water continuing to overflow for some hours, and then all remaining quiet as usual.

Last September the same pond in Luton began to overflow suddenly, which created alarm in the minds of the inhabitants, who apprehended that this circumstance was the indication of some earthquake on the Continent; this was afterwards known to have been actually the case.

It is remarkable that several earthquakes were felt about the sixteenth of December 1809, in distant countries, when the phenomenon, of which I have given an account, happened at Rine in the county of Longford; and though the distance between the places where they occurred and Ireland, is so very great as to make it improbable, it is not absolutely impossible that a communication may exist between them.

Mr. Engeworth on the Bogs surrounding Edgworth Town.

Instances of the inefficacy of mere draining.

I have carefully examined many places where former attempts had been made to improve red Bog, particularly in Bogs No. 1, and No. 9, as may be seen in Appendix No. 5. Drains of six or seven feet wide, and as many feet deep, had been made from the centre of the Bog to the streams that separate it from dry land; these were about twenty perches asunder, and though they had been made upwards of twenty years ago, the land between them was not in any respect different from what had not been drained. In (the float Bog) No. 2, two large Drains had been made fifty years ago to enclose a road. They are at present open, and only thirty-two feet distant from each other; but the ground which had been marked out for a road between these ditches remains nearly in the same state as the Bog on each side of it; excepting indeed the narrow banks formed by the stuff thrown out of the Drains; this stuff, whether from its becoming drier, or from its exposure to the air, certainly in all cases, where it is turned up, does become more capable of supporting vegetation than it was in its former state. I learn, therefore, from experiments made long ago, and from what has repeatedly passed before my eyes, that the improvement of these Bogs does not require many or deep Drains.* I have lately received from Mr. Edward Wakefield a strong corroboration of this opinion. He informs me, that a gentleman of much respectability, after having literally sunk Ten thousand Pounds in draining one part of a Bog, has since succeeded in improving another part of the same Bog at a small expense, by Surface-Draining. I think it will not be improper in this place to mention an improvement which I made upon part of a Bog of my own, about twenty-five years ago. The Bog and Moor consisted of twenty-seven acres. It was on the borders of my own Turf Bog, and part of it had been partially cut away, but

Stuff thrown out of Drains, more fertile than other parts of the Bog.

Reasons against deep draining.

Mr. Wakefield. Fact furnished by him.

Account of an Improvement on a Bog of Mr. Edgeworth's without deep draining.

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* Eaton on Bogs.

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there were still four or five feet of turf above whiteish sterile clay; I inclosed it with a seven-feet ditch, cut down to the white clay, where it was necessary to preserve a fall for the water; but in other places the ditch was not cut to the bottom of the Bog, only a few slight Surface-Drains of small dimensions were cut in proper places. The Bog, which as the summer was dry, could bear cattle, was ploughed with a skinning plough, and the stuff that had been turned up was burned, yielding a large quantity of red ashes; a coat of Limestone Gravel of an inch and an half in thickness was spread on one third of this ground; another third was covered with quick-lime; and the remaining third with marle, which was brought from the distance of a quarter of a mile; with respect to the quantity of each of these materials, I followed no other rule than to limit the expense to what the Limestone Gravel on the first portion of Bog had cost, knowing that the worth of every improvement is to be determined by comparing the produce with the money expended. The experiment succeeded far beyond my hopes; no material difference appeared in the returns made by these three portions of Bog during five years, whilst it remained in my hands.

At the commencement of the business, a tenant to whom I had let the neighbouring land, declined to take this Farm at half-a-guinea per acre; I took it into my own hands; and I accounted regularly with my agent for that rent yearly. I never had one hundred pounds capital employed; and by an accurate account now in my possession, it appears, that after having my capital reimbursed, and after the payment of rent and every contingent expense, including wear and tear of instruments of husbandry, and of overseer's wages, I had at the end of five years gained seventeen pounds clear profit; and at that period, when the land was in Meadow, I let it to the farmer who had before refused it at half-a-guinea, at the rent of Thirty shillings per acre, on a lease for his own life.—It is now worth double that rent. This experiment is not related as evidence of the success of Surface-Draining, but as a proof that marle, limestone-gravel, or lime, if applied in proper quanties are nearly of equal use.

Improvement made by Bishop of Kildare.

The most judicious mode of improvement of Bog, that I have ever met with, is clearly and ably described in a Note to Mr. Griffith's Report, which I saw when mine was nearly transcribed. Here the hard bottom of the Bog was at the greatest depth only twenty-two feet below the surface. The Bishop of Kildare who directed this improvement wisely dug to the bottom, because the expense was not too great in this instance; but where Bogs are from forty to forty-seven feet deep, the cost could never be repaired by any mode of treatment with which I am acquainted.

Form of Drains laid down in Map No. 1.

As to the forms of the few Drains which are laid down in the Map, No. 1, I propose that they should be made with perpendicular sides, which I prefer to those which are made either with a considerable talus, or in steps; I once thought the latter mode the best, but from observations made on common Turf-Bogs, and from reasoning on the subject, I have changed my opinion.

Sole or bottom should be an inverted Arch. See Fig. 4.

The sides of Bog-Holes, as they are called, where turf (or peat) has been cut, are always perpendicular, and unless water lodges at the bottom of the holes, and melts away the foundation of the Bank, it seldom gives way. All Drains (except Canals) in Bogs I would make narrow, viz. 5 feet by 3, to save expense; to secure the bottom of these Drains, and to preserve the water in a narrow channel, I propose to make the sole of the Drain an inverted arch, as represented (Fig. 4.) in the annexed plate.

Deep Drains.
Though Mr. E. disapproves of them, he adds hints to make them more useful.

Though I disapprove of making large and deep Drains in my District, yet it may be proper for me here to communicate to the Board some observations upon this subject, which may be useful in other Districts where Canals or deep Drains are deemed advisable.

Pumps to be worked by Windmills.

In the first place, there are some situations where there are depositions of water lower in particular places than the general level of proposed Canals, and lower than the neighbouring Rivers; in such places pumps may be sunk, which may be worked by such windmills as are used in the fens in Lincolnshire.

Coffre-dams or Caisons.

Archimedes' Water-screw. See Appendix, No. 3.

In the next place, there are in some Bogs depôts of Marle, where that manure is not to be found in the vicinity; in these situations the most certain, and, in the end, the cheapest, method, is to form a Coffre-dam or Caisson of large extent; pointed planks driven through the Bog to the hard bottom will be sufficient, if placed circularly to support the Bog-stuff on the outside, whilst the workmen are removing the stuff within; after the excavation has been made, the whole must be puddled, and kept free from water by an Archimedes Water-Screw, and a Windmill, as described in Appendix, No. 3.

Such a machine may also be advantageously employed in raising Marle or Soft Limestone Clay from the bottoms of Rivers, where they happen to abound; in such situations the Windmills and Screw-pumps, as they are popularly called, must be erected upon floats in the River, and the Screw-pumps must be placed at an angle not exceeding twenty-five degrees.

They will then, if properly made, raise semi-fluid materials with certainty. In this way of working to raise Marle there will be a considerable waste of power from friction; but the power of the wind is so great, where it can be applied safely, and where continuity of work is not required, that small mechanical resistance from friction is easily overcome. I am aware that the wind is not an economic power; that all machinery that has been hitherto exposed to its influence is liable to frequent accidents and to expensive repairs; and the force employed always bears but a small proportion to the bulk and cost of the organ.

Therefore good Mechanics are not disposed to call it into use, except in particular situations. Not having ever seen Steam Engines worked by Turf, I cannot recommend their use in draining or irrigating Bogs; but it is probable that they may be employed with advantage. In the last place, with respect to Drains in Bogs, it will be necessary to have frequent Bridges or Passages from one part of the Bog to another. These Passages may be left untouched in cutting the Drains, and by scooping out the earth underneath them, small shores may be made for the water from one part of the Drains to the other, so that in fact, where the size of the Drains makes it worth while to do so, half the cutting of these Drains may be spared, because half the surface may be left for the Passages.

Small shores and bridges left over them.

How far it may be useful to make subterranean passages to drain Bogs, I have not had sufficient opportunity to determine, but I have made some experiments on this subject with an instrument, which I call a Seton-plough. This instrument is described in Appendix, Nº 3.

Seton-plough. See Appendix, No. 3.

Besides the use of Canals and wide Trenches for draining Bogs, it is proposed by some Engineers to employ Canals as the means of transporting Clay, Limestone-Gravel or other earths or manures over the whole surface of a Bog; it is obvious that this must be done either with or without the intervention of wheelharrows. In the latter case the Canals must be so near each other as to permit the stuff that is emptied from the boats to be immediately spread with a shovel: in the former, the load must be first emptied on the banks of the Canal, and afterwards be thrown into wheelbarrows, thus requiring to be raised twice, which will occasion double cost in a most material article of expense. Though in this district such a proceeding is not advisable, it may be practised perhaps elsewhere; and to facilitate putting out clay by boats I have described in Appendix No. 2, a Machine which I used in 1772 on the Rhone. Where this system of Canals is adopted I should recommend wooden locks instead of stone; I would make them narrow, and frame them so as to be easily removable from place to place.

Canals for transport of Clay, Manure, &c.

Canals for transport of Clay, Gravel, &c.

. Not advisable in District No 7.

But where such Canals are advisable, a machine for loading may be useful. See Appendix, No. 2.

Wooden Locks recommended instead of stone.

Having thus presumed to give a decided opinion against cutting large Canals in the Bogs in my District, either for the purpose of Drainage or of carriage of Manure, I shall proceed to point out the means which I would pursue in attempting to reclaim a large portion of Bog.

I would in the first place cut off all the springs and sloughs by appropriate Drains, and then, whenever a Bog, as at No. 8, is covered with thin heath or weak plants of any other sort, I should endeavour in the first place to burn off the rough surface in a dry summer, merely by setting fire to the heath, and permitting the fire to spread itself wherever it could meet with fuel. In other Bogs where the roots of plants are strong and deeply sunk under the surface, I would immediately proceed to turn up the whole of the Bog with a long loy, a tool which is common in the western part of Ireland; besides which I should require grubbing-tools.

Means proposed by Mr. E. for improving Bogs.

As I advanced I would cut narrow Drains of eighteen inches deep, with narrow Essex draining-tools, wherever water lodged on the surface; and Drains of fit dimensions wherever springs occurred which I had not previously discovered.

The thick tough surface of the Bog should be piled up in ridges to dry, and where the Turf so dried yielded Ashes that contained Manure, as much of it as is possible should be burned in the rows as they stand, to save the expense of making it into heaps; what remains unburned after this attempt should be collected in heaps and burned to ashes. The next operation is to put out some kind of Clay upon the ashes after they have been spread, taking care soon to cover them with earth, to prevent them from being blown away.

Burning the surface of Bogs.

I propose for this purpose to employ wooden portable Railways, shod with iron; upon these portable Railways appropriate carriages are to be employed; these are made to empty at either side of the Railway, and when loaded with half a ton of earth, one of them can be easily pushed forward by one man. I had the honour of showing these Railways to several of my friends, in 1787, at the house of Mr. Foster, who was then Speaker of the House of Commons of Ireland. The advantages proposed by this construction were to extend the use of Railways to temporary purposes, and to reduce the expenses considerably, by dividing into several parts the weight which is usually loaded on one carriage, so that the Railway might be reduced in weight and cost, without being more liable to break than those that are in common use.

Portable wooden railways recommended.

Have been tried.

This plan has since been successfully adopted in many places, particularly at Penrhyn Slate Quary, where a number of small carriages, loaded lightly, supply the place of one larger carriage; by these means, iron Railways may be made sufficiently strong, though not one fourth part of the weight or cost of ordinary Railways.

A number of small Carriages to be used on railways instead of large Carriages.

I propose that these portable Railways should be supported on piles of five or six feet long, driven into the Bog, and that they should be removed from place to place, so that after a series of Railways had been laid, to the distance of half a mile, for instance; and after the carriage had emptied its loads on each side of it, the Railway may be detached, and placed at the distance of two perches, parallel to its former situation; these Railways are described, and an estimate given of their cost in Appendix, No. 4. It will thence appear, that the share per acre of the capital of £. 500, expended on the Railways and Carriages, would, on 1,200 acres, amount to about five shillings per acre; wear and tear about three shillings more; spreading, gravelling, and removing machines, about ten shillings. This

Mr. E's railways to be supported in Bogs on piles driven into Bog.

Portable rail-ways recommended and Estimate of their Expence given, Appendix, No. 4.

estimate is made on the supposition that the Machines and Railways would last four or five years, the time necessary for completing the improvement of 1,200 acres, so as to make the land worth 30 shillings per acre; the expense of the whole per acre would be nearly as follows:

Expense of reclaiming a Bog by putting out Clay with portable railways for one acre.

	£.	s.	d.
Wear and tear, and share of capital, per acre -	—	8	—
Draining - - - - - - - -	—	10	—
Turning up surface - - - - - -	2	13	—
Digging and filling Clay, &c. - - - -	2	13	—
Carrying out Clay on moveable Railways - -	1	14	—
Spreading Clay and shifting the Railway - -	—	10	—
Damages for Gravel-pit - - - - - -	—	7	—
Irish	£. 8	15	—

(Equal to £. 5 English per English acre.)

Estimate of ditto for whole District, No. 7.

To improve the Bogs of the whole District, viz. 21,367 Irish acres, would, according to this estimate, cos £. 181,619 Irish, equal to £. 167,648 English, for 34,569 English acres; thus a permanent income of nearly Thirty thousand Pounds English could be obtained at less than six years purchase.

Value of Bog improved by putting out Clay.

I consider the plan that is here recommended as the first stage of improvement; and I believe that it would make the Bog worth Five and Twenty and Thirty Shillings per acre.

Reclaimed Bog may be further improved at small expense.

Substantial and intelligent Farmers would for half as much more double its value; poor Tenants, if they are allowed to have more than a Garden, and as much Land as will support a Cow, with grass and hay, would soon wear out what had been done. Reclaimed Bog must be continually attended to; and if red Ashes are to be found below the surface, and Lime in any form be within reach, the Bog may be made worth Four Pounds per acre.

The above estimate may appear too low.

Estimates generally fall short.

I have stated, that the first stage of improvement of a Bog, which is in fact by far the most difficult of any other, may be accomplished for £. 8. 15. Irish per Irish acre, equal to £. 5 English per English acre; I am well aware that this appears to be a very low charge, and not unlike those estimates which sanguine or interested Engineers hold out to induce the Public to pursue some favourite scheme of the Projector: But what is here laid down is taken from the common prices of work, and from repeated experience of the machinery that is to be employed. Wherever I have been consulted as an Engineer I have never been unwilling to undertake the work in question, according to my own estimate, with a reasonable addition to cover accidents, and to give an adequate compensation for my trouble, and for the interest of the money which must be advanced. I should therefore stipulate for one third more than my estimate, were I to undertake the improvement of any considerable quantity of Bog.

To those who are conversant with large undertakings, this will appear no unreasonable security against the losses and disappointments that never fail to occur in carrying on the best concerted projects. Few great Buildings, Docks, Fortifications, or Canals, are executed for less than double the original estimate.

Something new or unforeseen happens, some alterations of the plan, or deficiency of the materials, is discovered; and when the work has advanced for some time, it is found better to complete it at an increased expense than to abandon it altogether.

Offer to improve a thousand acres of Bog.

As I never was more thoroughly convinced of the feasibility of any project than of that upon which I now offer my opinion, I hold myself ready to undertake the reclaiming One thousand Irish acres of a Bog of middling quality; that is to say, between what is most easy and what is most difficult, in this District, for Eleven thousand six hundred Pounds Irish, which is one-third more than the amount of the foregoing estimate; at the same rate 1,000 English acres would cost £.7,800 English; if a considerable number of acres of Bog were thus undertaken by persons who could give good security for the performance of their contracts, the improvement of the Bogs of Ireland would of course gradually follow.

Planting Bogs.

Many Bogs after they have been drained to a certain degree are capable of being planted, without any further care than to dig up and break the surface round each plant; wherever water settles after the trees are planted, it must of course be drawn off. One of the surest indications of the fitness of any Bog for a plantation, is the flourishing appearance of the plants already growing in or near the Bog.

Inland plantation may be carried too far.

In planting Bog attention should be paid to the probability of a demand for the timber. Near the coast all kinds, and any quantity of timber may be advantageously disposed of; in this District nothing but oak, ash and fir, would be profitable.

Trials of the soil should be made previously to planting.

Planting Bogs might change the face of the country.

It appears to me that Bogs apparently alike are not always equally proper for the same kinds of trees, it would therefore be prudent to make previous trials before the large plantations should be undertaken. Most Bogs may be prepared for trees by culture; I should therefore recommend that plantations for shelter and ornament should be made on every Bog that is improved; a judicious assortment of timber trees on those Bogs would not only be profitable, but would entirely change the face of the country. If large plantations were made they should be towards the middle of the Bogs, lest they should prevent that free

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current of air that is necessary to keep the ground sufficiently dry. One advantage attends the plantation of Bog, that is not to be met with elsewhere:

The Drains that are necessary in a Bog may be so disposed as to form inclosures for trees without any additional expense. It will not be difficult for a person of taste, who is at the same time a skilful planter, to lay out Bogs so as to become highly ornamental, without producing more shelter than is wanting:

In the choice of trees, experience alone should be the guide; in some Bogs, as in some soils, one species of tree will not grow, whilst another flourishes in full vigour. I have seen oak flourish well, where ash was wretchedly stunted: Perhaps oak may succeed in shallow Bogs when the plant has strength enough to force its roots downward through eight or ten feet of Bog to solid earth below. I do not however recollect to have seen oak growing far from the edges of a Bog; and I have been told, by a gentlemen of observation, that the roots of no trees can live in the lower part of deep Bogs. My own experience on this subject is but limited. I have seen large and strong Scotch fir in deep Bogs, and some good alder. Aquatic trees, it is said, have the property of drying wet ground, where they have taken root; if this be the case, they might be employed as *preparatory crops*. Timber sally, or salix viminalis, is commonly found in Bogs; whether it will thrive in them in their present state I do not know; but I have reason to believe that common osiers do not grow well in such soil.

Planting Bogs with suitable trees.

Other purposes to which reclaimed Bog may be applied.

The other purposes to which reclaimed Bog may be applied are so various, and so much the same as those for which other land may be used, that it is not necessary in the present stage of the business to enter into any minute detail upon the subject. The rich will at first plant ruta-baga, and hemp; the poor, potatoes and flax; and according to the views of the Legislature to encourage the poor to cultivate hemp, the most certain method is to engage for the purchase, at a fixed price, for all hemp raised within a given time. Let the price be liberal, and payable at the principal Market Towns in the neighbourhood, without affidavits or certificates. Some slight frauds may be attempted; but encouragement for perjury will be thus avoided; and even the few attempts to deceive, that may be practised in the beginning, will be discouraged by the fair dealer. The peasant from his own experience, by taking into account the loss of time, and credit, will by degrees learn to conduct himself more wisely and more honestly.

Means of encouraging the growth of Hemp.

Bogs well treated amply repay the Cost of Improvement.

The more remote employment of reclaimed Bog should not be unnoticed; it is a common belief that after some time it returns to its former state. This opinion I have heard most frequently from persons who were at the time feeding cattle upon reclaimed Bog; these unconscionable people, after taking two crops of Potatoes, and two of oats, from the new land, sowed it with coarse Grass-seed; mowed it till it no longer yielded meadow; and then complained that it was throwing money away to improve Bog.

Reclaimed Bog, like other Land, must be refreshed with Manure.

In most of the cases that I have examined, I have found that the capital laid out has been accurately remembered, but that the returns made by the first crops were forgotten, so that only the present produce of the worn-out soil was considered as the return for the original expense of improvement. Had continual additions of limestone gravel and clay been made to the soil, the expense would have been amply repaid, and the soil would at length have become permanently profitable.

Improvements of Bog compared with Improvements of Land of the best quality.

I have also heard it asserted, that Ten Pounds per acre laid out upon the best land in Ireland, would yield more profit than if laid out upon an acre of Bog, or other unreclaimed land; this is one of those vague assertions which are made without any foundation in experience, but merely to supply the want of something better to say. If this were the case, why should bills for the inclosure of commons pass every year in England?—Why should not the boundless capital of British Merchants raise the value of land near the metropolis, tenfold every year?—It is true that every acre of ground near London might be converted into a dunghill; but though a dunghill and a hot bed are the most productive soils for Asparagus and Cabbage, could the butter of Ireland, or the cheese of England, be produced by Cows fed on dunghills?—The garden culture of Battersea and Brompton is carried to the highest perfection, and it is profitable, but not to such a degree as to invite that species of competition which always follows high profits.

Scheme of improving Bogs proposed by the Dutch.

The scheme of improving the Bogs of Ireland is by no means new. The Dutch, in the time of King William, offered, upon condition of being governed by their own laws, to form a colony in the Queen's County, and to make meadow of the whole Bog of Allen.—(*v.* Philosophical Survey of the South of Ireland, page 126.)—In fact, the experience of ages teaches what Bacon has told us, that great gains are to be made by parsimony or by new inventions.

It is not surprizing that the project of improving Irish Bogs should have occurred at different periods, both to individuals who had only their own profit in view, and to the patriots who are zealous for the prosperity of their country.

Undoubtedly it is an object of the highest importance to the State, and particularly to this portion of the empire, because the modes of life are such in Ireland as would immediately be suited to the cultivation of the kind of soil which may be obtained by the first stage of improvement in Bogs. Much of the cultivation among the great mass of the people in Ireland is carried on by the labour of men without the plough; the tender soil of newly-reclaimed Bog might not for some time bear the tread of cattle, though it might be manufactured by the spade and shovel; and a time will come when many thousand hardy Irishmen

Reclaimed Bog peculiarly suited to Irish husbandry.

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must return from the Army and Navy to their own country; where to find employment of any sort will not be very easy, and where the wages of ordinary labour are much lower than a soldier's pay; but in the cultivation of land, fit for the immediate production of the common food of the country, they would find a resource against idleness; as they would, if they were assisted by the gift of some timber from the Proprietors of the Bogs, soon build themselves habitations, and would thus have a reasonable hope of being able to support families. Independently of this more remote speculation, we see that in this part of the country the population increases rapidly, and that the fathers of families, when their sons grow up, are obliged to divide their small farms among their children, a system, as Lord Selkirk has shown, in his excellent Essay on Emigration, to be the most destructive of happiness that can be followed in an agricultural country, where there is no means of adding to the quantity of profitable land.

Survey of the Bogs in itself advantageous to Ireland.

But even if the means proposed for bringing our Bogs to this state of cultivation should not ultimately succeed, yet our labours have not been in vain; to have surveyed our Bogs; to have acquired the most exact knowledge of the levels of their surface; of the depth and consistency of the soil which lies beneath them; of the direction and fall of the Streams and Rivers which intersect them, and which may carry off their superfluous water to the sea, is undoubtedly advantageous to the country, as it enables us to determine, either, that to reclaim our Bogs is impracticable, and a project too expensive; or, on the contrary, that there are well-founded hopes of success. Further, to enable the Nation to decide whether this project be a vain speculation and a job, or a useful feasible plan, let an hundred acres of Bog be procured, by rent or purchase, in every District which has been surveyed under the Orders of your Board; and let such Plans as your Board approves be fairly put in practice, under the inspection of Engineers of your appointment; let the expense be limited within a certain sum per acre, and the result will be before the Public. If it be unfavourable to the scheme, it will at all events be allowed, that the Surveys made under the orders of the Board are valuable materials for a Topography of Ireland; that the inquiry will have raised a spirit of research, and habits of accuracy, that were unknown on such subjects in this part of the United Empire; and that it has introduced into the country a considerable number of excellent instruments, which will oblige Surveyors hereafter to study the construction of Mathematical Instruments, and to be ashamed of such tools as were formerly in use.

Experiments should be tried of the best method of improving Bog in every District.

At all events the surveys that have been made will be useful.

I have seen a Surveyor of extensive practice employ a circumferentor, the sights of which were tied on with packthread; and another, *with an iron nut and screw*, to one of the legs of his instrument, within an inch of the needle!

Consequence of successful experiments.

Instead of the miserable scrawls which were given in as Maps of Gentlemen's estates, none but distinct and exact surveys will now be tolerated. If this improvement in the professional habits of numbers of men of understanding, which had been previously cultivated by a certain degree of science, be not in itself a great advantage, there is no faith in the experience of the past, nor any trust in the hope, that as men become enlightened they become better citizens.

Capital might be advanced upon good security.

But if these Plans and these experiments succeed, the benefit will be instantly perceived, and permanently felt; no person possessed of Bog can fail to wish for its improvement; and all that can then be wanting would be Capital. This might perhaps be safely advanced upon landed security, to landed proprietors, and at such times, and by such degrees, as would leave but little probability of loss, or temptation to fraud. But without the assistance of Government, if we succeed even upon a small scale, British capital will soon be found ready to carry on such profitable work to a large extent. Those who are tremblingly alive to every interference with their property, even with those parts of it which yield them nothing at present, and give no hope of ever yielding any thing, would embrace eagerly a proposal that should leave this darling property untouched by any hand but their own, and which should hold out to them a certain prospect of gain.

All proprietors would imitate successful improvements.

The improvement of Irish Bogs has been a favourite object with every true patriot who has written on the affairs of Ireland. There is, in particular, an excellent Essay, written near 150 years ago, upon this subject, in the "Philosophical Transactions," (Lowthorp's Abridgment, Vol 2. page 732,) in which there is the following passage:

"An Act of Parliament should be made that they who did not, at such a time, make "some progress in Draining their Bogs, should part with them to others that would."

This is strict justice in every nation upon earth. No man, from prescription or from any grant, has a right to monopolize and withhold the soil from cultivation. Could the proprietors of the Coal-mines and Salt-pits in England be permitted to combine and shut them all up? Or could the owners of all the Bogs in Ireland lawfully combine to prevent them from being cut for Turbary?

Fortunately for Society such extreme cases do not often occur. Motives of interest in time overcome the caprice of pride; and when mankind clearly perceive private advantage and general utility in any national undertaking, the narrow prejudices of a few are soon despised and overborne; and those who had been most clamorous in their resistance become the most vehement partizans of the very project which they had formerly opposed.

28th October, 1810.

Richard Lovell Edgeworth.

Mr. EDGEWORTH's description of different sorts of Machinery used in draining and cultivating Bogs.

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MACHINE for loading and unloading BOATS:

TO facilitate the loading and unloading of Boats on Canals I should recommend a Machine, which I employed in 1772, in the works which I then carried on upon the Rhone. It was used with great advantage in transporting earth from one side of the Rhone, to fill up expeditiously an outlet of that River, so as to force the current into a new channel.

An upright (U), was raised on each side of the Boat (B). These uprights were braced on each side at *(b b)* to keep them steady. Upon these uprights was placed a long and strong axle-tree, upon which the table or body of a cart turned, so as to empty its contents over the side of the boat. This table was supported by props on one side, and held in its place by the chain (C).

The ground on the bank of the River was very low, being flooded in winter; it was not therefore possible to load this Machine merely by the shovel; besides time would have been lost whilst the boat crossed the river. I therefore constructed a kind of subsidiary cart, raised upon piles, as a receptacle (R), which was filled by men with baskets, which they carried on their heads from the pits, where the earth was dug.

By means of the wide gang-way (G) which was supported by the piles, and by a trissel (S) loaded with sand, they had easy access to the receptacle or cart (R), the numbers of these men were so calculated that they could just fill the receptacle (R), whilst the boat was passing and re-passing the River; and the moment that the boat had returned to the shore the load was poured into it without delay from the receptacle.

Where the land from which the clay is to be taken is on the side of a hill, advantage might be made of this machinery, which upon trial on a very extensive scale was found to succeed in accomplishing its purpose.

Where the height of the gravel-pit does not make it necessary, the upper cart and the gang-way may be omitted; in many places the cart or table raised on the boat will save time and labour.

Description of a MACHINE for taking Sections of a RIVER:

PLATE 1. Figure (2), is a perspective view of the Machine. The drum (D) covered with paper, is turned slowly round by the intervention of perpetual screws and wheels, (W W) which receive their motion from a spiral wheel (H), that lies under the surface of the stream.

As the whole Machine which floats on the water by means of the two hollow cylinders of tin (C. C.) is drawn after a boat, the spiral wheel is made to turn by the resistance of the water; whilst the drum is moving round, the long tail (T) is lifted up by every inequality of the bottom of the River, and as it rises up and down, it moves an arm which is hinged at *(h)* to the frame of the Machine, this arm pushes backward and forward a rod (R) that holds a pencil (P), the point of which marks the motion of the tail upon the paper. The tail has also a motion sideways on pivots (P P), which permits it to move in curved lines where it is necessary. (H) is the spiral wheel turning under water. (S), a perpetual screw turning a wheel. (S), another perpetual screw on the axis of the wheel which turns the wheel (W), which being fastened on the axis of the Drum (D) turns it round under the pencil (P). Each of the wheels (W W) having sixty teeth, the spiral makes 3,600 turns, while the drum makes but one.

The tail (T) is a hollow tube of tin, which fills with water, and becomes sufficiently heavy to sink, but when lifted out of the water, it is light and easily portable, because the water falls out of it.

The manner in which the tail moves the arm (A) and the rod (R) which are connected at 1 and 2 by hinges, is sufficiently obvious from inspection. This motion, by means of hinges, is wonderfully steady. It is used in the common instruments for dividing clock-work, and it was used by Ramsden, and is used by Troughton for dividing Mathematical Instruments.

The drum turns round nearly once in every two miles, and the pencil moves in a space nearly equal to one eighth of the space through which the tail moves when it moves up and down. The scale at the bottom of the plate shows the measure of the different parts of the Machine with sufficient accuracy. The paper is fastened on the drum by a ruler of wood, which by means of the screw (N) presses the paper against a part of the drum, which is made rough by being punched outwards with a sharp punch, so as to have small protuberances like a nutmeg-grater.

It is not necessary that the drum should go round exactly in two miles, or with any other fixed velocity, nor that the short arm and the tail should bear any given proportion to each other; provided that the length of the short arm (A) is any aliquot part of the length of the tail, it will be easy to reduce the Section delineated on the paper to any requisite scale.

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It is obvious, that the distances measured by the spiral wheel must be different, when the Machine goes with or against the stream: but if the river is measured backward and forward, the mean between these measures will be very near the truth; but for an exact survey a map should be previously made of the River, and the principal reaches of the River; or any other remarkable objects should be marked on the banks of the River, by stakes or hillocks, and they should be noted correspondently on the Map, as the Machine proceeds, so that any errors that might occur in the measurement by the spiral wheel could never accumulate, because they could occur only between one fixed point and another on the banks; and as these points are transferred to the paper, they must be accurate notices of the places observed by the person who conducts the Machine.

The steadiness with which this Machine floats, and the accuracy of its performance, gave me great satisfaction. Were I to wish for any alteration, it should be in the numbers of the wheel-work, which I would make lower, to permit the drum to turn faster: and I might also wish to alter the relative proportions of the arm and the tail, which I would make such as to mark shorter lines upon paper.

The Sections accompanying the Maps belonging to this Report were taken in a very short time, and with great facility. The country people, from the easy motion of the Machine on the water, and from its size and shining appearance, gave it the name of the Swan. The Boatmen, with an epithet taken from its use, called it the Learned Swan.

Windmills for raising Water:

There are various Machines employed for raising Water by Wind; the Windmill working a common pump by a crank is a good and simple Machine; perhaps it may be more securely mounted than it is at present, by using an open pyramidal frame, to support the Windmill; this Windmill should turn on gudgeons at each end of its axis within side of the frame, and the whole frame should turn round with its base upon a solid circular floor, well fastened to the ground; by the intervention of rollers the frame would turn easily as the wind changed, by its action on a vane fastened to the frame.

Archimedes' screw is the best machine that can be employed for raising Water to a height of eight or ten feet, as for instance, to throw the water of a river upon its banks for the purposes of irrigation.

Besides this application of the screw-pump, to the raising of Water, they may be used effectually for the taking of Marle up from the bottom of rivers.

In the Inny there are places where Marle and Clay are found in beds twenty feet thick over the rock; here a Windmill of the common sort might be erected on a flat-bottomed boat; it might easily be removed from place to place, and Marle might thus be obtained at an easy rate.

Description of a Carriage on moveable Railways:

THESE moveable railways are formed of joists of deal, of any convenient length, from eight to twelve feet long, five inches deep, and two inches broad; I generally cut them to the length of the rafters of any house that I am building, because they serve very well for roofing after they have been employed some time as railways; they are formed into frames, with two parallel sides, two feet six inches asunder from outside to outside by transverse pieces, made of common deals, bog-oak, or any common timber, about four inches broad, then transverse pieces are placed about three feet from each other, and they are nailed to the bottom of the parallel joints; they project a little beyond the joists as at (*fffff*) to add to the steadiness of the frame by giving it a broader base.

There are also brackets (*b*) (*b*) (*b*) &c. to keep the joists upright and in their places.

To connect each frame with that which follows it, the last transverse-rail or foot of the frame, projects half its breadth beyond the joist at (g,) to serve for the foot of the succeeding frame, so that this foot being common to two frames, there is no interruption; where the frames join, where a large quantity of work is to be done, it will be good economy to cover the joints with iron; what is called kieve-iron answers well for this purpose; the moveable railways will however do very well without iron; a number of coarse pieces of refuse timber, eight or ten inches long, and five or six broad, and of various thicknesses, will be necessary to be placed underneath the joists to support them in hollow places.

In soft or boggy ground the feet of the railways must be laid upon short piles, proportioned in length or bulk to the hardness or softness of the Bog.

It is to be observed, that the railways are subjected to the pressure of the carriages only for a short time, and as the carriages move continually without jolts, and as they are never heavily loaded, the pressure is at no time considerable.

The machines or carts adapted to these moveable railways are constructed as follows: The wooden wheels (W W) are eight inches broad, and two feet high, with an iron axle-tree on which they are made fast. The axle-tree has two gudgeons of steel, turned in a lathe, and upon these the wooden wheels also are turned; and afterwards they are covered, or shod with iron, so thin as to adapt itself to the circumference of the wheels, without

altering

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altering the truth of the wheels materially. The frame which contains these wheels is of ash, about four inches and a half deep, and two inches thick. Its length without the shafts (*s h*) which are made separately, is four feet. Upon this frame are erected two upright pieces (U) which are braced at *b b b b*, to keep them steady.

These support a transom or piece (T), to which they are strongly fastened by mortises and tenons. This piece, which projects beyond the frame, and beyond the uprights, is supported where it projects, by iron stays (I I).

This transom, or piece (T), serves for a fixed axle, upon which the body of the cart or table (C) turns, not as the body of a common cart turns, or is emptied, but sideways; and this table is so hung that it may be emptied on either side of the railway. There is hinged to each side of this table a leaf, which is let down when the carriage is emptied. Its use is to prevent the gravel from falling against the railway. It is omitted in the drawing, to prevent confusion.

The shafts (*s h*) and their small wheels serve as guides to the Machine, to prevent the principal wheels (W W) from rolling off the railways; the shafts are furnished with two small iron wheels (*w w*) eight inches diameter, which carry but little of the weight of the cart, and also with two small guide-wheels (*w* . . . .) which turn horizontally against the sides of the railways. To prevent these guide-wheels from rising up, and so permitting the small wheels (*w w*) to slip off the railway, there is a small ledge (l.) nailed to the side of the railway; this ledge projects over the edges of the guide-wheels.

As this method of keeping carriages on railways depends upon principles different from those upon which common railway carriages are constructed, I shall explain the difference between them.

The usual carriages that run upon railways have four wheels, each pair of which are fixed upon an axletree that turns with the wheels; as both the wheels on the same axletree are exactly of the same diameter, neither of them would advance beyond the other, unless it were retarded or propelled by some extraneous cause, so that the axletrees and wheels must upon an even surface, such as a railway, always advance in a straight line till they are diverted from it by some external cause; and as the wheels are on the sole a little hollow in the middle, their concavity tends to restore them to their proper situation, if they are pushed out of their usual direction.

But still there is a considerable resistance opposed to the righting of the wheels, from the friction of their concave surfaces against the railways, when they cease to move in their proper direction.

A similar cause of friction subsists between the small wheels here described, and their railways, but then the weight that is incumbent upon them is so small as to occasion no inconvenience. The large wheels of my machine are made eight inches broad, to guard against their being thrown off the railway by any accident. By this construction the large wheels are kept very steadily in their places; the moment they are disturbed, they are brought back to their proper situation by the guides, which hold the ends of the shafts to the sides of the railways, so that however obliquely the large wheels are situate on the railway, the guide-wheels tend to force the shafts into a situation parallel to the railway, and the large wheels follow their guidance.

This carriage mounted on the railway moves with great facility and steadiness. The props (P.) that hold the table up are readily removed, and the load falls without any violent shock. To keep the load whilst it is falling from encumbering the railway, a leaf is hung at each side of the table, which is turned down to the ground when the carriage is emptying.

The friction of this machine on the centres of the wheels is inconsiderable, not amounting to more than the four hundredth part of the incumbent weight, which is in general about half a ton, the four hundredth part of which is not three pounds. To move the carriage when the railway is solid and level requires eight or ten pounds, so that the resistance from rolling amounts to six or seven pounds, but when the wheels are shod with iron, or made of cast-iron, and the railways covered with iron, the carriage on a level railway moves with more facility.

This however is not intended as a statement of the force actually necessary in common; the force then exerted must, on uneven ground, and from various circumstances, be considerably greater for instance at the boundaries of Bogs; where Bogs suddenly ascend, it requires the thirtieth of the incumbent weight, and sometimes more, to force it up hill; but such sudden slopes are never continued for more than three or four hundred yards, and as the stuff which is to be carried out must be raised near these slopes, assistance is at hand from the labourers who dig the stuff.

Nothing remains to be said as to these moveable railways, and the carriages belonging to them, but to explain the manner in which they are removed from one line of carriage to another.

Each frame of the railway should be about twelve or fourteen long, and about three load should be emptied on each side of each of these frames; as soon as this has been accomplished the carriage passes on to the end of the railway, and there it is received by a tourniquet or

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frame which turns upon a centre, and conveys the carriage round to a road, at right angles to its former direction; and in the same manner the carriage turns upon another tourniquet at the end, so that it comes back to the pit where it was filled. And thus a succession of carriages may be filled and emptied on each side of the railway, both going and returning.

When about one fourth of the ground, at the greatest distance from the pit, has been covered, the rails may be taken up and laid down at the extremity of a new line, and so on through the whole distance; that is to say, when another convenient portion of the railway has been used, it may be transported to a new line.

It is proposed that one set of frames, half a mile long, should have twenty or more carriages employed upon them, with a proper number of men to load the carts, drive them out, spread the gravel, and remove the railways from place to place.

The operations carried on by this set of workmen would not prevent another set with railways and carriages from working near them; so that a number of men, with proper apparatus, might be employed on one Bog; but for the convenience of procuring labourers, it would be advisable to carry on work in different directions and in different Bogs at the same time. Thus five gangs of workmen might reclaim Five thousand acres of Bog in one year, after the proper machinery had been provided.

The Expense of this Apparatus might be thus stated:

Railways of deal-joist, five inches by two, with kieve hoop iron, per perch - - - - - - - - - - - -	£. 1 10 0
A Carriage adapted to ditto - - - - - - - - - -	6 — —

Upon these moveable railways I do not pretend to calculate merely from theory, but from the experience which I had of their utility several years ago, in conveying a very large quantity of limestone to the distance of three quarters of a mile, for manuring land. They answered my expectations; and were I to have occasion to carry out a large quantity of heavy materials on ground that was not hilly, I should employ them in preference to any other mode of land-carriage with which I am acquainted.

I have lately learned that Mr. Roscoe, after various trials of other means, has employed wooden railways and light carriages in improving a peat-moss in Lancashire. The scheme of dividing a heavy load and placing it on several carriages, to diminish the pressure on the Road, was laid by me before the Society for the Encouragement of Arts, &c. in 1766.

SETON-PLOUGH.

THE chief difficulty that prevents the cultivation of Bog, is the impossibility of employing cattle of any sort to plough them, or to put out Manure upon them. But there are cases, in which tools usually drawn by Horses or Bullocks, might on Bogs be drawn by Men.

The Mole-plough is an instrument of this sort; it is, Plough with a conical sock of three inches diameter at the larger end, and sharp at the other extremity; this sock is connected with the Plough-beam by two coulters, which are so long as to permit the sock to run from ten to twenty inches below the surface, while the beam runs near the top of the ground. The coulters cut a passage for themselves, while at the same time they conduct the share, so as to form a cylindrical drain in the earth, which in certain clay soils preserves its shape after the Mole-ploughshare has been withdrawn, and furnishes a permanent passage for water.

I have seen this Plough used with great and lasting advantage in a stiff clay soil; but it is obviously unfit for Bog, the parts of which would fall in and coalesce as soon as the share should be withdrawn; were it not for this the Mole-plough might be drawn by men to advantage, as it is certainly the cheapest instrument for draining land, that is injured by water lying upon its surface or near it.

But I have made an improvement on this instrument, that has adapted it to the drainage of Bogs, even where the soil, if soil it may be called, is so soft as to collapse, wherever a channel of moderate depth has been cut in it.

The sock of this Plough is not more than three inches diameter in its thickest part. An eye or loop is formed at the hinder part, to which a hay, straw, or what is still more easy to be procured, a rope made of heath, may be attached; this rope is drawn through the channel made by a sock, and when as long a rope as can be drawn forward without breaking has been lodged beneath the surface, the chain to which the rope was fastened must be pulled up, and another piece of rope must be joined to it.

This operation may be performed by men, at the rate of one half-penny per perch. Of its efficacy in draining Bog I cannot speak from experience; but if pipes formed in this manner were within one yard of each other, they would cost little more than Forty shillings per acre.

Other methods of making frequent narrow Drains in Bogs have occurred to me, but I forbear to mention them till I have tried them effectually; Drains of all sorts in Bogs are liable to close, and sometimes to be filled up, by the compression of the superior parts of the Bog, which, as somewhat fluid, press not only downwards but in all directions. To ascertain the effects of this pressure on Bog at different depths, I tried the following experiments:

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To determine the compressability of Bog at different depths I had one piece cut from the top, another from the middle, and a third from the bottom of the face of a Turf-hole sixteen feet deep: after having cut away some feet of the outside of the bank, each of them were successively pressed in an iron cylinder, five feet high and four feet diameter, placed on an iron plate with holes in it, with some hay placed over it to prevent the Bog-stuff from passing through.

First Experiment:

	lbs
8 inches of Bog reduced to 3 inches, by - - - - - -	336
8 inches of Bog taken from the middle, to 2 inches, by - -	336
8 inches of Bog from the bottom, to 4 inches, by - - -	700

Eight inches of the upper part of the Bog put into the cylinder, not in the same manner in which it stood in the Bog, but with that part of it put downwards which was before placed laterally in the Bog.

Second Experiment:

	Inches.
8 inches of surface Bog was pressed by 224 pounds for four hours, and reduced to	4
8 inches of Bog taken at 4 feet depth, and pressed with 224 pounds for 4 hours, reduced to - - - - - - - - - - - -	3½
8 inches of the Bog taken at 8 feet depth, pressed with only 168 pounds weight, and for the same time, was reduced to - - - - - - -	1½

From the first set of experiments it appears that the middle of the Bog required less force to compress it than the top required; and that the bottom of the Bog, as was to be supposed, required a weight many times greater than what was necessary to compress the middle or the bottom.

From the second set of experiments it appears, that when Bog is pressed sidewise it follows a different law, the bottom then requiring considerably less force to compress it than the top required.

Third Experiment:

	Inches.
8 inches of surface was reduced by the pressure of 224 pounds in a quarter of an hour to - - - - - - - - - - - -	4½
8 inches of middle Bog reduced by the same weight and in the same time to -	5
8 inches of bottom reduced by the same weight and in the same time to -	1½

It appears from the third set of experiments, that the bottom of the Bog, contrary to the first set of experiments, was by far more compressible than either the middle or the top; this difference is attributable to the greater quantity of water contained in the bottom of the fresh Bog, than what was contained in the upper part; and the total difference between the first and second set of experiments arises from three specimens of Bog, in the former having been reduced to equal drynesss, by their having been dug out of the Bog a fortnight before they were used, whereas the latter specimens were all of them very wet, the uppermost, being the driest, sinks the least when the water it contains is pressed from it; the lowest stratum sinking the most, from its parting with most water.

(11.)—REP. II.—Letter from Sir *Humphry Davy*, on the nature of Bogs, &c.

Copy of a LETTER from Professor DAVY, to the Secretary of the Commissioners.

Sir, 1st February 1811.

AS the Commissioners for considering the practicability of draining the Bogs of Ireland have done me the honour of requesting my opinion on the important national object to which their attention is directed, I shall without apology beg leave to communicate to them, through your means, such observations as I have been able to make on the subject.

Bogs in general are known to consist of inert vegetable matter, covered more or less with unproductive vegetables, and containing a large quantity of stagnant water. There are two causes why they are unfitted for cultivation. One is the existence of stagnant moisture, the other is the excess of inert vegetable matter.

There is but one mode of removing the stagnant water, which belongs to the practical Engineer, and that is by draining; the different modes of effecting this have been so ably discussed in the Reports before the Commissioners, and which they were pleased to request me to peruse, that it would be presumptuous in me to offer any observations upon this part of the Enquiry.

The mode of removing the excess of inert vegetable matter, and of rendering it useful, is a subject which more immediately comes within the province of chemistry; and on this I shall venture to offer some suggestions.

Bogs differ very much in their composition. In general 100 parts of dry peat contain from 60 to 90 parts of matter destructable by fire, and the residuum consists of earths,

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usually of the same kind as the sub-stratum of clay, marle, gravel, or rock, on which they are found, and oxide of iron. Burning furnishes a simple mode of destroying the inert vegetable matter, and where the peat contains much earthy matter, tends to supply that which is necessary to every fertile soil, a due proportion of the earths. From the analyses of Mr. Griffith of several specimens of a particular Bog, it appears however that this practice will not be universally applicable, for be found 1,440 parts of several specimens of peat affording only from 12 to 50 parts of ashes; the proportions being greatest in the lower strata. In cases when lime can be applied to the surface of Bogs, there can be no doubt of its beneficial efficacy. If used in its state of quicklime, it not only destroys excess of vegetable matter, but forms a compost extremely favourable to the vegetation of esculent plants. The peat-hills of Derbyshire have many of them been rapidly brought into cultivation, by merely draining, and scattering lime over the surface; and treated in this way, they admit I believe of being ploughed up the second year, and sown with Oats, or planted with Potatoes. Any kind of soil will improve peat; sand, clay, or marle, must be all beneficial, because a great object is to increase the quantity of earth in proportion to the vegetable matter. If a peat is of a black colour, soft consistence, and contains living vegetables at the surface, it will probably be easy of improvement by liming, or the application of the earths. If it is an inert red peat, containing little decomposing vegetable matter, and having only moss at its surface, there is reason to conceive that attempts at improvement should be preceded by burning the surface.

To render Bogs arable land capable of bearing white crops, there must be a certain quantity of earth added to the vegetable matter, or a certain quantity of vegetable matter destroyed, but it appears probable that many Bogs may be made into good pasture by draining and sowing indigenous or foreign grasses, particularly if irrigation can be employed. In England this practice has been particularly successful. At Priestly near Woburn, and at Castle Acre, there are meadows which have been rapidly reclaimed from Bog, and which produce luxuriant and excellent crops of Grass in consequence of Irrigation.

The Commissioners will appreciate the value and importance of my excellent friend Dr. Richardson's ideas on the improvement of Bogs, by cultivating on them the indigenous Irish Grasses.

From a comparison of the able Reports of Messrs. Edgeworth and Griffith, it appears evident that very different plans of cultivation must be adopted in different cases. The chemical composition of Bogs, and the ashes they afford, differ exceedingly, as I have found in various experiments upon specimens of peat from different districts.

The peat of the chalk counties of England contains much gypsum; but I have found very little in any specimens from Ireland or Scotland; and in general these peats contain very little saline matter.

There are peculiar advantages which will strike every one in judging of the practicability of improving most of the great Bogs in Ireland, the quantity of limestone and limestone-gravel in the neighbouring districts, and the marl or clay which in so many cases forms the sub-stratum of the Bog. If the draining can be easily effected, if the upper stratum can by mechanical means be freed from its excess of water, there is no doubt that its cultivation might be rapidly effected.

A few experiments upon the modes of improving these Bogs most unlike each other, would be, perhaps, the best preliminary step towards laying the foundations for the great national undertaking.

This would probably lead to particular plans for each particular district, which would be directed by a minute knowledge of the local circumstances, and by chemical analyses, pointing out the particular nature of the peat.

A soil covered with peat is a soil covered not only with fuel but likewise with manure. It is the excess of manure only which is detrimental; and it is much more easy to destroy it than to create it. To cultivate a Bog is a much less difficult task than to improve a sand. If there is a proper level to admit of draining, the larger the scale of operation the less must the comparative expense be, because machinery may for many purposes take the place of manual labour; and the trials that have been already made by private individuals, and which are stated in the different Reports, prove not only the feasibility of the general project, but afford strong grounds to believe that any capital expended upon it, after mature and well-digested plans, would in a very few years afford a great and increasing interest, and would contribute to the wealth, prosperity and population of Ireland.

I have the honour to be, Sir,
Your most obedient Servant,

H. Davy.

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REP. III.—Mr. *Longfield*, on the District of Lough Gara, in Roscommon; instances of successful improvement, &c.

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Mr. LONGFIELD, on the District of Lough Gara, in the Counties of Roscommon, Sligo, and Mayo.

Mr. OWEN O'CONNOR, of Ballinegar, has also made some small experiments of Bog improvement some years back, the expense of which, *including gravelling*, cost him about £.6 per acre, and the piece thus reclaimed is a good bottom pasture to this day; it however now begins to throw up rushes, and will require to be again broken or limed to destroy their growth.

As a general observation, I shall here mention the particular result of some improvements made by Lord Dillon's cottagers at Aughalour, near Loch Glyn, which being done by *persons unaided by capital or scientific knowledge*, proves beyond a doubt, that where personal skill is accompanied by the aid of both, the result must be equal to the expectations of the most sanguine, particularly if the operations are carried on in situations equally favourable as that wherein the improvements alluded to have been effected, and which, in the greater part of this district are frequently to be met with.

[Mr. Longfield then proceeds to give the Statement relative to Lord Dillon's tenants, which is contained in the Third Report.]

In this place I must beg to mention a circumstance, proving my former opinion of the retentive nature of red sponge Bogs, which is simply this; that on making the pits to raise the gravel from under the Bog of Aughalour (the surface of which was in its state of nature, as wet as any other Bog) it was found, after passing with difficulty through five, six or eight feet of Bog and water, that on raising the first shovel or two of gravel from the bottom of the pit, the whole of the water which the hole contained immediately disappeared, and that so long as the bottom of the pit was kept clear of Bog-stuff, it remained quite dry; but if, on the contrary, there remained only *six inches of Bog-stuff* in the bottom of the pit, it was sufficient to retain all the waters received by it.

[Mr. Longfield then proceeds to give the Statement relative to the culture of Fiorin grass on the Bogs of Mr. French, which is contained in the Third Report.]

Considering the subject in general, I have not met any country where the reclaimage of Bog could be carried on with such prospects of success, or with such superior advantages, as this district affords; and therefore the system of drainage, which I have the honour to recommend to your consideration, will, I trust, be found simple and practicable, and not exceeding the bounds of moderate expense, when compared with the great benefits to be expected from reducing this part of the Bogs of Ireland to a state fit to receive agricultural improvements.

It is impossible, in so great an extent of district, containing Bogs so different in their circumstances and capability of drainage, to lay down any precise system, applying equally to all Bogs, whether *high, low, deep, shallow, wet or dry*; all which considerations must be distinctly attended to in carrying on the proposed works with economy and effect. However, as it is necessary to give some general idea of the proposed system I mean to recommend, I shall here briefly state that plan which appears to me best calculated to attain the desired object.

First, the natural ventage streams and cushes of the Bogs should be opened, so as to discharge the waters drawn to them by minor and surface drains; but how far the sinking of those streams and cushes are necessary, or can be effected, is only to be determined by the section of each particular line, where the fall of the whole is ascertained; and therefore the sinkings of each line must depend on the level of its local discharging point. No distance can be named as the space between these lines of ventage; but whenever they naturally occur, they should be opened and improved; therefore they may be called the first class of main drains, or natural ventage.

The second class are main drains, laid out pretty central in the lowest vales of the wettest parts of the Bogs, and also lines of catchwater or land drains, the sinkings of which in general will be from seven to ten feet; some of these may be converted into navigable cuts for conveyance of gravel, &c.; but as they are only to be adopted where necessary, they cannot be laid out at equal distances.

The third class are minor drains, six feet deep, nine feet wide, and three feet at bottom, laid out generally at about forty perches asunder, and falling into the main drains and outlet streams, in such directions as to obtain the best fall of the surface. Where the Bogs are deep and wet, I propose that cross minor drains should be cut parallel to, and about forty perches from, the main outlets, so as to cut up the Bogs in patches of about forty perches square, or ten acres each; which patches, I propose, should then be divided into four parts by the fourth and last class called surface drains, as recommended in my report of the river Brusna district, subdividing the said ten acres into parallelograms of two and a half acres each, which, I am inclined to think, will turn out to be the average of the whole of the Bog divisions when effectually drained. In this district, where the Bogs differ so much in circumstances of wet and dry, shaking and firm, I have found it expedient to estimate this part of the system, by the acre at sixteen shillings, averaging the whole surface drainage at eighty perches for every ten acres, at two shillings per perch; which price will not only include the making of the drains in the first instance, but will be sufficient to defray the expense of scouring for the first three years.

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These last descriptions of surface drains I recommend to be the same as mentioned in my former report, namely, perpendicular drains four feet wide, four feet deep, and four feet at bottom; and the second and third classes I propose to be three feet at bottom, with battered sides, rising at the rate of six inches to a foot on each side; so that a drain, when ten feet deep, will be thirteen feet wide at top, and three feet wide at bottom. Widening on the top, at the rate of a foot in breadth for every foot in depth of the first class, must all depend on circumstances, and therefore no particular scale can be laid down for them.

In my Report of the fifth district, where the average depth of the Bog is twenty-five feet, I recommended the third class or minor drain to be made eight feet deep; but as the Bogs of this district are in general much shallower, drier, and more numerously intersected by natural ventages, I have, on consideration deemed it advisable to reduce the minor drains to a depth of six feet, which I am convinced will be as efficacious in the Bogs of Roscommon and Mayo, as eight foot drains in the deep Bogs of Allen.

Bog bridges stand well.

In addition to this system of communicating Bog bridges (as recommended in my last Report), formed by leaving about five or six feet of the line of Bog drain uncut, at intervals of every twenty or thirty perches, through which a passage for the water is perforated on a level with the bottom of the rest of the drain, and this can be done without incurring any additional expense. On my last survey, I have seen some of these bridges in the Bog of Croghan, which had lasted in a perfect state then twenty years, and were as good at that time as when they were first formed. I need scarcely add, that the system of screen planting, also before recommended, might be here adopted with equal advantages, particularly if due regard is paid to the proper aspect on which they are laid out.

It may not be improper here to remark, that the population of the county of Roscommon (although generally considered as a grazing county) is exceedingly great, so much so, that every little island or peninsula in the Bogs, contains more than an ordinary proportion of inhabitants; as an instance of which I shall mention one island near Lough Glynn of 107 acres, called Cloonborny, that contains no less than twenty-one families, being little more than five acres to each house, and for which they pay a rent of not less than forty shillings per acre. It is therefore not to be wondered at, that multitudes of these poor peasants emigrate annually to England, where by two or three months hard labour, they are enabled to save the rent of their little farms at home; and I must say, such is the want of employment for the poor, in this part of the country, that I never met men who would go farther or labour harder for a shilling than Connaught-men; nay, it is a fact, that some of the attendants who were with me on the survey, declared they had not the like opportunity to earn money for many years before, although the hire did not exceed 1*s.* 8*d.* per day. In an agricultural point of view, there can be no hesitation to acknowledge the advantages resulting from the reclaimage of Bogs, particularly where the under-stratum, in their natural state of wetness, does not exceed a depth of from 10 to 20 feet, which by the effect of drainage may be reduced at least one-third, bringing the surface down to within 6, 8, or 12 feet of the gravel, which if porous (as at Aughalour) can, with little difficulty be raised to the surface, there being no impediment by under-water. In a political point of view, I am aware the advantages are equally great, and they may be thus explained: first, by reclaiming the Bogs you increase the profitable soil, and thereby multiply its inhabitants; secondly, the improvement of these extensive tracts, affording labour to the population, will draw their attention from carrying on the illicit trade of distillation, which is now a disgrace to the country in general, and a serious loss to those fair dealers who are not concerned in it; and thirdly, the proposed improvements will make open and accessible at all points, those districts wherein such illicit trade is carried on, and thereby do away the great inducement to private distillation, namely, the difficulty of access to the interior, where the corn is manufactured; what the full extent of this trade amounts to, or how far the revenue of Ireland is injured by it, I am not prepared to say; but this much I verily believe, that in the county of Roscommon, nay, I might say in the whole province of Connaught, there is not one gallon of licensed spirits in every hundred gallons of its consumption, which together with the immense expenditure in vainly endeavouring to prevent it, may be a proper subject of inquiry for those persons whose duty it may be to equalize the burdens of the nation.

In making these general observations, I trust I may not be accused of straying from the particular subject to which my attention should be directed; being of opinion that the more the advantages of bog-drainage can be fairly demonstrated, as tending to promote the general prosperity and resources of the kingdom, the more fully will the objects of the inquiry be satisfactorily attained.

In this bog, as in almost all in the district, very little improvement has been effected. However, there has been an experiment made, which proves the speculation both practicable and profitable; what I allude to is a piece of the bog of Rattallen, containing about two English acres.

This piece, if my information be correct, was inclosed about nine years ago, and after producing five profitable crops, was let out to grass, in which state it remains at present;

and although now rather turning to rushes for want of a top-dressing, is admitted to be worth one guinea per acre. The rotation of crops was, first, cabbage plants; second and third, potatoes, which the neighbouring farmers acknowledge to have paid abundantly the expenses of improvement; after which it gave two crops of oats, and is now in the state above described, worth one guinea per Irish acre. This experiment certainly has been made on the verge of the land, where there is abundance of the finest limestone in rock and gravel. But independent of that circumstance, the bog was originally no better in point of nature, than any part of the interior, being a complete red sponge bog nearly 20 feet deep.

REP. III.—Mr. *Aher*, on the Bogs between Roscrea and Killenaul, in Tipperary, Kilkenny, and Queen's County; with a Plate, exhibiting the Section of a Turf Bank and plan of cutting drains;—general descriptions and observations; comparison of expense and profit of various plans; instances of improvement; varieties of crops, &c.

Mr. Aher on the Bogs between Roscrea and Killenaul, in Tipperary, Kilkenny, and Queen's County.

AS I shall have occasion to use some terms in the course of this Report, which may require explanation, I beg to be understood, that I use the word Moss, in the same sense as botanists, expressing the plant only, and not applied to the bog generally, as it is frequently used by others.

Explanation of Terms: Moss.

Bog, Peat, and Turf, are used as synonymous terms, expressing that substance of which the bogs are composed.

Bog, Peat, and Turf.

By fibrous Peat, or Red Bog, is meant the moss or other vegetable substance, whose organization is perceptible, yet approaching towards a state of decay, but not completely decomposed; it cuts with difficulty by the spade, from its tough and fibrous nature, and is seldom used for the purpose of fuel; its colour is red, or reddish brown, thence called Red Bog.

Fibrous Peat, or Red Bog.

Fluid Peat, is when the bog is supersaturated with water, so that it appears to be in a semiliquid state, consisting principally of decayed moss, of a yellowish red colour, with a large portion of water. This is sometimes called Flow Peat, or Quagmire.

Fluid Peat, or Quagmire.

Compact Peat, or Black Bog, is that blackish carbonaceous substance, which appears to have been formed by the decomposition of vegetable matter. When dried, it is used as fuel, burning freely with a bright flame.

Compact Peat or Black Bog.

Turbary, or Turf Bog, is that firm part of the bog, composed principally of compact peat, which is used as fuel.

Turbary, or Turf Bog.

In treating of the composition of Bogs, I shall treat only of those immediately in this district; on examining which, I have reason to think, that they differ from other bogs in formation and composition.

The surfaces of the bogs in this district, present a very regular appearance, resembling extensive plains, rising gently towards the interior; frequently the swell near the edge is rather sudden, forming an elevation of 30 or 40 degrees. In all instances the surface of the interior is much higher than at the verge of the bog, but seldom exceeds 20 feet; the greatest depth of bog is 33 feet, and decreasing from that depth to a few inches, the average depth of the district being 17 feet. And it is remarkable, that the deepest parts of the bog are not always in the middle, but frequently within forty or fifty yards of the verge.

General appearance of the Bogs.
The surface at the interior higher than at the verge.
Average depth of Bog, 17 feet.
The deepest part sometimes near the verge.

The bog generally rests on a stratum of clay, from a few inches to 6 feet in depth, on marl of one or two feet deep, or on gravel of an unknown depth, and in some instances on rock. The base of the bog forms a very uneven surface, being principally composed of small hills, and ridges of limestone gravel.

Substrata of the Bog, clay, marl, gravel, and sometimes rock.

The substances of which the mass of the bog is composed, consist of numerous species of moss, amongst which the Sphagnum, or Bog moss, is by far the most considerable: the others are chiefly the Hypaum or Feather moss; Polytrichum or Hair moss; Lichen Rangiferinus, or Rein Deer moss; Lichen Pyxidatus or Cup moss, with various other plants; which as the Lemna or duck meat, the Conferva, the Iris, the Scirpus or Rush grass, the Eriophorum or Cotton grass, the Agrostis Stolonifera, or Fiorin grass, with different kinds of ferns, and a few varieties of heath, amongst which, Erica vulgares predominates; yet compared to other bogs in this country, heath is rather thinly scattered over the surface.

Substances of which the mass of the Bog is composed.
Mosses and other plants.

Generally, for a foot under the surface, the organization of the Sphagnum is perfectly discernable, exhibiting the structure of the plant, which is sometimes seen, even to the depth of four or five feet, through which its progressive changes may be traced to a state of decay, from the living vegetable until it imperceptibly becomes completely disorganized, and decomposed; forming what I have already termed compact peat, whose thickness or depth is variable.

The organization of the Sphagnum may be traced to the depth of four or five feet.

When the verge of the bog is dry and firm, and the compact peat of tolerable thickness, it generally becomes turbary, and is cut away for fuel; and as this is performed with some regularity, the turf banks are kept with a perpendicular face of fourteen or sixteen feet in

Description of a Turf Bank.

Rep. III. Mr. Aber.

depth, which affords the observer frequent opportunities of viewing the different banks, examining with accuracy its composition, and tracing its varieties, which generally speaking, may be as follows: the surface exhibits a congeries of plants in a growing state, already described, whose roots are interwoven, and sometimes matted together, from one to five feet thick; the sphagnum is observed proceeding from the perfect, to the almost disorganized moss, but yet the fibres are visible; this being unfit for fuel, is thrown aside as useless, and is called by the turf cutters the cleaning. Next, from one to two feet, is a fibrous light spongy turf, which does not burn well, and exhibits the vegetable in some degree with decayed twigs or branches of heath, and sometimes reeds or rushes; from thence to the gravel or clay (which may be from six to twelve feet thick;) it consists of a dark brown or blackish peat, with small twigs of heath and rushes sometimes interspersed; this, on being dried, burns extremely well, with a bright flame, and giving out a strong heat. Frequently, at the distance of about four or five feet above the gravel, is seen a stratum of broken branches of one foot or more in thickness, consisting of birch, beech and hazel; these branches are mostly about two or three inches in diameter, and seldom more than two or three feet long; the woody fibrous part, as well as the inner bark, is completely decayed, whilst the cuticle or outward membrane of the bark, particularly of the birch, still remains in a high state of preservation, retaining its bright and silvery lustre, being much less susceptible of decomposition by putrefaction, which it is so powerfully enabled to resist, from the nature of its component parts. Small branches of heath are also found at every depth; but near the bottom they are much decayed. The best and most durable turf for burning, is that which is near the clay or gravel, and is sometimes of a peculiar quality, which is denominated stone turf, from its hardness and great specific gravity.

Small branches of birch, hazel, &c. found at four or five feet above the bottom of the Bog.

The outward part of the bark not decayed.

Stone turf the best for fuel.

Renovated Pits.

Old pits or turf holes are sometimes found filled with a new growth of moss; these having now been cut through, give an opportunity of presenting a section of a renovated pit, as in figure 4, where the surface appears to have sunk in the centre, on being deprived of its water. This new growth consists of some of the varieties of the Hypnum and Sphagnum, and seems perfectly distinct from the original formation with which it is in contact, and in some respects not the same variety of plant. No part of this new formation has yet undergone the process of decomposition, or even far advanced in a state of decay. There are other pits, in which the process of renovation appears to be going on, where the tender fibres of the conferva are spreading like a green film on the surface of the stagnant water; and the lemna or duck meat, whose slender stalks extend for two or three feet, to float its leaves on the surface; those by interweaving with other aquatics, may form a receptacle or bed for the deposition of the light and almost imperceptible seeds of mosses, which are blown about in abundance at the season of their shedding. Such are the appearances which present themselves; but I do not venture to say, how far nature may carry on this work, or what the ultimate effects may be towards a complete renovation of the pit.

And here it may be necessary to observe, that it had been the practice with the peasantry, sometime ago, to select the most convenient place to cut their turf from, without attending to the present better regulated system; they commenced with what they termed cleaning, that is throwing the surface of the Bog, for a few feet in depth, into the next adjoining pit, until they came to the compact peat; this surface being chiefly composed of the living moss, continued its vegetative powers in its new situation. The age of those pits, according to the report of the inhabitants, might have been forty or fifty years.

Matting of grass and other plants.

Very frequently, various plants, of which grass seems to be the principal, are found growing so completely interwoven and twisted together, as to form a matting on the surface of the water, or the fluid peat, capable of bearing the weight of men, but not without yielding to the pressure very considerably, and admitting the water through it; there is a matting of this kind, in Division No. 7, over a very sluggish stream of seven or eight feet deep; and there is a similar one on fluid peat, in Division No. 8, near Derrylong Island, which is described in the line section 27. This kind of vegetation on the surface is very frequent in swamps and marshes.

In these instances, the vegetation seems to have been produced on the surface of the water, where each successive growth of vegetables, by their weight, had sunk the former, until at length they reached the bottom; or, perhaps, as the upper surface accumulates, the lower becomes decomposed, precipitating the carbonaceous matter of the plants.

Dried moss retains its vegetative power for a long period.

Mosses possess the peculiar property of vegetating after they have been a long time preserved in a dry state; this in some degree shews the difficulty of destroying that vegetable life, of which they are so tenaceous. The sphagnum, from its formation, is peculiarly adapted for holding water in suspension, which it greedily attracts, and loses only by evaporation and decomposition.

The sphagnum is well adapted for holding water.

If a stem or branch of dried sphagnum, six or eight inches long, be suspended, and having a small portion of the lower extremity immersed in or touching water, the fluid will rise by capillary attraction to the upper extremity of the branch; filling all the leaves of the plant, which in this instance acts as so many little vessels to retain the water.

Old roots and trunks of trees found in the Bogs.

Large roots, and trunks of trees, are commonly found in the Bogs, several feet under the surface; they consist principally of fir, oak, yew, and very rarely elm; the fir roots are found generally resting on a stratum of peat, from two to eight feet thick, which separates them from the clay, on which I have seldom seen them resting. They are sometimes found in great abundance, of a large size, and within three or four yards of each other; the roots in a standing position, as they grew, with about one or two feet of the trunk remaining attached to them; the trunks are often got near them, on the same level with the root, but lying in an horizontal situation, or nearly so, sometimes with, and sometimes without the branches.

Roots and trunks of old trees.

I have not, in any instance, seen the roots of the fir-tree upset, or the trunk adhering to the roots. The roots are found numerous, and very often without any trunks; in all cases, the roots are decidedly the most numerous, even where the trunks are found in the greatest abundance.

The fir roots are not found attached to their trunks.
Roots more numerous than trunks.

On examining some hundreds of these firs, I have not yet perceived the marks of cutting or burning; they appear to have fallen from decay, and to have been partially destroyed by time; the external fibrous part very much decayed, but the internal part of the trunk sound; the timber is used for many essential purposes, and bears a high price at present. The fir roots and trunks possess a high degree of inflammability, from the resin they contain, which I have found in a concrete state in great quantities in the roots, between the bark and woody fibre; in one instance I have met with in the vicinity of fir-tree roots, oozing out of a turf bank in small quantities, assuming the appearance of tallow, as it lay thinly spread on the surface of the peat; it burns with a strong destructive blaze, giving much smoke, and leaving no residue when burnt in the open air. The peasantry know the value of the fir roots so well that they dry them, and separate them from the fibres longitudinally, which serve all the purposes of candles, burning freely with a strong flame, and continuing until the wood is consumed.

The fir trees have not the marks of cutting or burning, but seem to have fallen from decay.

Fir roots contain much resin.

The peat immediately in contact with it, is denominated greasy turf, and forms a stratum of about two or three feet thick; it is very bituminous, and burns rapidly, with a bright flame, leaving very little residue; this bituminous quality it receives from the great mass of fir trees which are imbedded in it, and are most copious in the deposition of turpentine, giving a whitish colour to the peat. This bituminous turf is not found but in the vicinity of these trees, seldom extending for more than a foot above and below the roots. The bark of the fir trees is found sometimes in great quantities in layers near the top of the root, which separate in scales, and are in a high state of preservation; I mention this to shew, that at the depth of twelve or fourteen feet from the surface, in compact peat, the bark is not always changed into that substance, as has been supposed by some writers.

The turf found in contact with these roots, burns rapidly.

The bituminous turf forms a stratum seldom exceeding two feet thick.

Bark not always changed into peat.

I have observed another formation of branches, from twenty inches to two feet under that already mentioned, and about two feet over the gravel or earth on which the Bog rests; they were destitute of a fibrous or organized appearance, completely inflammable, though deposited in an highly inflammable peat; by drying, one half the bulk is lost.

Another formation of branches uninflammable.

As the roots of fir trees spread themselves horizontally, they require greater room than those of the oak, or other roots found in the Bog, and when they are within three or four yards of each other, they spread themselves under or over those of the nearest tree, in such a manner as would induce many to imagine they were distinct growths.

Fir roots occupy more space than those of the other trees found in the Bog.

Oak and yew trees are also found scattered near the verge of the Bogs, but not by any means so general as the fir; they rest mostly on clay or gravel, seldom with a foot of peat between the trunk and the gravel; these trunks are found attached to a part of the root, at least very rarely without it, so as to prove they were neither cut or burned, but probably fell from decay assisted by a tempest; they lie horizontally, the ends not pointing in any particular direction, and are not found as far in the interior of the Bog as the fir trees, but yet frequently covered with eight or ten feet of turf; their being almost invariably attached to their roots, forms a striking contrast with the fir trees, which I have never found so.

Oak and yew found near the edges of the Bog.
The trunks of oak and yew being found attached to the roots, forms a striking contrast with the fir trees, which are not found so.

The yew is much esteemed for its neatness and durability in furniture, to which purpose it is generally applied by the farmers, being perfectly sound and retaining its natural colour.

The yew is generally used for furniture.

The oak, some of which becomes black, is highly valued for its great hardness and strength, and therefore always brings a high price; this black oak as it is called, probably receives its colour from the iron held in chemical solution in the water, and the gallic acid in that timber acting on each other; the blackness is greater where it ought to be expected, namely, at the last growth of woody fibres, where the vessels for secreting it from the other juices of the living tree are placed: its blackness has induced many to imagine that the tree had been partially burned or charred, which it much resembles.

Black oak probably receives its colour from the gallic acid in the timber, and the iron in the bog water.

I have seen but one tree of elm in the bog; it was found near a river, was tolerably sound and attached to its root, lying in a horizontal direction, the internal part was blackish, and the external part of the wood was grey, for an inch in thickness.

Elm trees seldom found in the Bog.

The upper surface of the oak or yew, as it lies horizontally in the Bog, is much decayed, and the woody fibres longitudinally detached from each other; sometimes the trunks are found partially rotted, and often hollow in the centre, as may be observed in very old and decayed trees of long standing, which have been destroyed before their fall by the ravages of time; the workmen are paid by the foot for raising this timber out of the Bog. Some of the islands of the Bog are yet thickly covered with roots of oak, ash, and sometimes holly trees; and as considerable quantities of old roots, trunks and branches of trees, are found at the edge of the Bogs, there can be little room to doubt that large tracts of this country were at distant periods, covered with wood. Roots or trunks of old trees are seldom found in the interior of the large Bogs in this district.

The upper surfaces of oak and yew are much decayed.

Some islands of the bog are covered with roots of oak, &c.

The islands are called Derries.

Almost all the islands in the Bogs are called derries, and sometimes woods; the word derry may be a corruption of the Irish word daire, which signifies an oak wood.

There are very few aged trees growing on the bogs.

Hazel, willow, and white thorn, are growing in the valleys in the bogs.

There are very few aged trees growing in these Bogs, except the holly, which are met with ten feet high, and are found growing in great luxuriance on compact peat of eight or ten feet in depth; hazel, willow, and white-thorn trees are found growing in the vales of the rivers which run through the Bogs.

The largest trunks of fir trees which I have seen in the Bog, were two feet six inches diameter, near the root, and forty feet in length; the oak was not quite as large, and the yew less than the oak.

The summits of the bogs are generally the deepest, and always the wettest parts;

and are composed of fluid peat interspersed with tufts of heaths, &c.

The summits are inaccessible in wet weather.

The summits or highest parts of these Bogs are generally the deepest, and invariably the wettest parts; in some instances they have large lakes or numerous pools of water covering a large portion of the surface; these summits are sometimes near the centre, often extending across the Bog, and sometimes near the verge; in all cases the summits are composed of fluid peat, on whose surface are interspersed innumerable little tufts, consisting of heath, moss and grass, all of which are matted together, and forming little islands, having an imperfect chain of connection, which in dry weather, admits a person accustomed to it to step from tuft to tuft without sinking much, but yet not without some risk to his personal safety; in wet weather these summits are quite impassable. There is generally an inch or two of water over the surface of the fluid peat in which those tufts are imbedded; this water being nearly transparent and colourless, has a better flavour than the water of the Bog at some distance from the summit, where it is turbid and ill flavoured, depositing a sediment of a brown colour.

They continue wet during the summer months.

In the summer months, when by evaporation the other parts of the Bog become dry and firm, the summit still continues wet, and supplied with water for two or three hundred acres in extent, giving out all the surplus water, which proceeds slowly from the summit in every direction, and forming the sources of such rivers as take their rise in the Bog; these rivers continue to run at all seasons without intermission.

Springs are often met with in the deepest part of the Bog, rushing up sometimes with much violence, and often strongly impregnated with sulphate of iron, carbonic acid, and earth. The water of almost all the springs in the Bog deposits oxyd of iron on the beds of the streams, in passing from the sources through the Bog.

The bottom of the Bog

consists principally of limestone gravel.

The base on which the Bogs in this district rest is principally limestone gravel, which I think cannot be very deep from the dip of the limestone quarries in the islands, and on each side of the Bog; and also from the circumstance of meeting with rock under the Bog, without any intervening substance. Sometimes, but not generally, as will be seen by the sections, there is a thin stratum of earth or marl between this gravel and the Bog, from a few inches to five or six feet in thickness, consisting of lime, alumine, and silex, in various proportions, with a small portion of oxyd of iron; generally the carbonate of lime predominates. But the great mass of the bottom of the Bogs consists of limestone gravel, having rounded pebbles from a very minute size to twelve inches diameter, sometimes embedded in clay.

Some islands in the Bog contain siliceous sand.

Some of the small hills or islands in the Bog consist principally of siliceous sand, which is also found occasionally near the Bog edge.

Strata of marl over the Bog of Urlingford.

That part of the Bog near the road leading from Johnstown to Urlingford, which is used as pasture, has, at the depth of about six inches under its surface, a stratum of white shell marl, varying in thickness from eight to twenty inches, the average being about fourteen inches. The shells, none of which exceed half an inch in length, are perfectly entire, and of a very delicate texture.

In one instance, I have observed two formations of marl, with about five or six inches of compact black peat intervening.

The Bog beneath these strata is of the black compact kind; its average thickness being about six feet.

Theory.

Most writers suppose that bogs have been formed by the destruction of forests.

The prevailing opinion of those who have written on the natural history of peat seems to be, that by the destruction of forests, which have been hewn down, burned, torn up by storms, or fallen by age or decay, the passage of the waters has been so impeded, that lakes were formed, which encouraged the growth of aquatic plants, and after the lapse of ages filled up the lakes, and assumed the form of peat or Bog; hence, they say, peat mosses are generally found in low flat countries.

Small lakes might have produced aquatic plants, whose decomposition formed black peat.

It may be possible that shallow lakes of a small extent of surface, and well sheltered, might produce aquatic plants, whose successive growth, and subsequent decomposition, formed the black peat, which we find at the bottom of the Bog; this substance, at length rising to the surface of the water, might have been a receptacle for the seeds of the sphagnum and other mosses which are fond of moisture.

This theory not applicable to the Bogs of this District.

There is invariably an ascent from the edge towards the interior of the Bog.

But this theory is not applicable to the Bogs of this District, whose outlets are sufficiently low to take off the water from the bottom, and through which outlets the surplus waters of the Bog continue to run. There is invariably an ascent from the edge towards the interior of the Bog, even where it is higher than the adjoining country, for some miles; this ascent is sometimes very gradual, and sometimes sudden, rising eighteen or twenty feet, at the distance of three or four hundred yards; where, in some instances the Bog is higher than the houses on the firm ground near its edge, and as high as the tops of the castles and steeples of the neighbouring country, without any rising ground intervening.

In some places the Bog is on a level with the tops of the steeples and castles of the adjoining country.

Trunks or roots of trees are seldom found at the outlets, or lowest passes of these Bogs, nor is there any appearance of obstruction to the free passage of the waters at those outlets. Such trees as are found, have generally six or seven feet of compact peat under their roots, which are found standing as they grew; evidently proving the formation of peat to have been previous to the growth of the trees.

Old trees seldom found at the outlets;

but when found, they are generally resting on 6 or 7 feet of turf, proving their growth to have been subsequent to the formation of the Bog.

It is a well known circumstance to every farmer, that a wet clay soil is ever productive of moss and rushes, and when left undisturbed accumulates fast, preventing the vegetation of the more useful plants along with them. The most effectual mode of destroying them is, by making drains to cut off the supply of water, by means of which their vegetation had been promoted; but were they allowed to remain undisturbed for centuries, with a sufficient supply of water, perhaps Bogs may have been formed from the successive growth of moss on the ruins or decay of the preceding.

Wet clayey soils produce moss and rushes;

and if left undisturbed, will increase rapidly.

Their growth may be prevented by drainage;

but if neglected, perhaps Bogs might have been formed.

The waters of the Bog generally contain carbonic acid, iron, lime, and other earths, and sometimes a small portion of sulphuric acid. Perhaps some peculiar property in the water may be necessary to contribute to the growth of Bog moss; more particularly so, when it is removed much above the gravel or clay, from whence it can no longer draw any of its nutriment; and as water is decomposed by living vegetables, the substances already mentioned are taken in by the plant, and are by its putrefaction precipitated from it; the carbon, iron, and earth, forming the peat, which receives its inflammable quality from the hydrogen that has been originally a compound part of the water.

Some peculiar quality in the water may be also necessary to promote the growth of Bog moss.

Theory of the formation of peat by the decomposition of vegetables and water.

Drainage.

From the foregoing facts I am led to conclude, that the wetness of those Bogs originates from springs within themselves, and that the principal springs must be at the summits; I am therefore of opinion, that it will be necessary to cut deep drains through the summits at proper distances, and of the dimensions hereafter to be described, for the purpose of intercepting the water of the springs, and giving it a free passage, with a sufficient fall to the most convenient outlet. If a very long period should be allowed for effecting this business, the drains need not be very numerous; for if a few large deep ones were cut from the most convenient outlet, through each summit, so as to communicate with one or more running through the summit lengthwise, to intercept and receive the water of the springs, they would, in some measure retard the growth of the moss, by depriving it of its usual supply of water, it would subside, and become, in process of time, sufficiently firm for agricultural improvements; but this I fear could not be accomplished within any moderate period, from its well known quality of retaining water for a great length of time.

The wetness of the Bogs originates from springs within themselves; the principal springs being at the summits.

Deep drains should be cut through the summits.

The drains need not be very numerous, if a long period should be allowed;

But this mode of drainage could not be accomplished for many years.

As all the parts of the Bog are not equally wet, I have thought it necessary to recommend four classes of Drains, to be used as circumstances may require, and of the following dimensions, *viz.*

Four classes of drains proposed.

First Class, or Main Drains, to be 18 feet wide at the top, 2 feet at bottom, and 12 feet deep.

First Class, or main drains.

Second Class, 12 feet wide at the top, 1 foot at bottom, and 9 feet deep.

Second Class.

Third Class, 6 feet wide at top, 1 foot at bottom, and 6 feet deep.

Third Class.

Fourth Class, or surface Drains, 3 feet wide at top, 6 inches at bottom, and 3 feet deep.

Fourth Class, or surface drains.

It is to be observed, that in all cases where it may be found necessary in cutting those drains to the greatest advantage, when the execution of the work takes place, that the depths above stated are merely the average depths on which the calculations for the estimates are founded; where circumstances are favourable they may be sunk to a much greater depth at the summits, whilst at the outlets only a few feet may be necessary.

The depths above stated are only the average depths.

As the rivers and streams which pass through the bogs are proposed to be converted into main drains, by sinking and widening their beds, there will be seldom any occasion for making new drains of the first class; which, on account of their dimensions, would be attended with very considerable expense. However, there are some situations where those large drains will be absolutely necessary.

The rivers and streams in the Bog may be used as main drains.

In all cases where it was admissible, I have laid down the lines of the drains in the shortest direction from the summits to the passes or outlets through which the water is proposed to be conveyed from the bogs; thereby giving the greatest possible fall. The drains of the second class are to be placed at the distance of forty Irish perches, or 280 yards asunder, passing through the summits and wettest parts of the bog; these will principally act towards effecting the complete drainage. Those of the third class are to be used occasionally at the same distance, and parallel to the second, where the bog is not very wet. And the fourth class, or surface drains, are so placed, that one runs between the second and third class

The lines of drains are laid out in the shortest direction from the summits to the outlets.

Proposed distances between the drains.

drains, and parallel thereto, at the distance of 20 perches or 140 yards asunder, and others at right angles to the latter also at 20 perches asunder, which would divide the bogs into squares of 2½ Irish acres.

The upland surface water does not contribute to the wetness of the Bogs; because there are natural catch-water drains on the Bog edge.

The surface water from the upland does not contribute to the wetness of the bogs in any part of this district, because there are almost always small streams running along the bog edge, which act as natural catch-water drains, and receive such water as falls from the upland, as well as that which falls from the upper parts of the bog; and it will be only necessary to deepen and widen the beds of those streams already formed by nature, so as to enable them to convey the water to the larger streams without interruption.

Drains with sloping sides are preferable to those with upright sides.

I have preferred the sloping-sided drains, from a conviction of their being best suited to wet bog, and which has been proved by experience.

Deep upright-sided drains could not possibly stand in fluid peat, where the sides have not sufficient stability to withstand the lateral pressure. Even in compact peat, I have witnessed many instances of the perpendicular banks having been undermined so much by the water, as to cause its falling in and choaking up the drain; and those which were originally formed with upright sides, by the crumbling down of the banks, have in the course of time assumed the form I recommended. Besides, sloping sided drains being narrow at the bottom, the running water will have the effect of keeping them free of obstructions more effectually than if the bottom was wide.

Upright-sided drains dangerous to cattle;

These reasons, together with their being so dangerous to cattle grazing at their perpendicular banks, are sufficient for rejecting them.

but shallow drains of that description may be used in firm Bog.

In firm bog, I admit that such drains may answer very well; but in these situations I shall have little occasion to use any very deep ones.

In firm Bog, the drains may be finished the first year;

and, in the wet summits, a longer period;

by beginning at the Bog edge, and reducing the depth of sinking as the wetness of the Bog increases;

resuming the work from year to year, until finished.

The mode of cutting those drains should vary according to the wetness or firmness of the bog. In the latter case, when it can be done with propriety, I would recommend the excavation to be made of the intended dimensions during the first year; and in the parts which are less firm, the work may be perfected in two successive years; but in the wettest parts, such as the summits, where the excavation would be filled up almost as soon as cut, I would recommend a longer period. In such cases the drains at the bog edge might be cut to the full dimensions in the first season, if the compactness of the peat would admit of it; the dimensions should be lessened as the fluidity of the bog increased, until it would no longer bear the cutting without collapsing. The drains thus made, would draw off a very considerable portion of the water, and would assist to consolidate the bog against the following season; when the work should be resumed, by commencing at that part of the drains nearest the edge of the bog, and which had been left unfinished the preceding season, still advancing towards the summit, as far as the nature of the bog would admit.

Thus I would proceed every year, until the work should be finally accomplished; by which means the cutting would not be rendered useless by the drain filling up, a circumstance that frequently occurs in very wet bog.

Method of cutting drains.

I have already stated, that in sinking drains through firm compact bog the excavation may be done to the full dimensions the first year; but when it becomes less solid, so as to require two operations, a quantity A C I. or A D H. (*vide* fig. 5.) equal to half or three-fourths of the intended dimensions may be sunk; and if the bog should be sufficiently firm the following year, the cutting may be finished.

But where the wetness of the bog will require three or more operations, I would propose the first to be from one-fourth to one-half the dimensions A B K. or A C I. of the width and depth. The next cutting may take place when the bog becomes somewhat consolidated by the drains already made, and this may extend from one-half to three-fourths of their dimensions A C I. or A D H. finishing it in the third or fourth operation, if necessary.

The excavation should be removed from the edge of the bank.

As it must appear obvious, that any weight on the edge of the banks of deep drains would materially injure them, before the bog should subside, and become firm, the excavated peat should be thrown, at least, seven feet from the edge of the bank.

The drains must be scoured when necessary.

When the work shall have been thus finished, it will be necessary to attend to the drains, and keep them open, by scouring at least once a year, until the bog subsides and becomes firm. Those at the wet summits (where the bog will subside most, from its containing a greater proportion of water) will require particular attention.

Bogs may be drained too much for the purposes of vegetation.

Dried turf cannot be brought to its original state.

As the drains have been laid out, they will generally admit of sufficient fall for conveying the water from the bottom of the bog, as well as from its surface, if they should be sunk to the clay or gravel; but I would not approve of sinking them to the bottom of the bog generally, lest it should be deprived of too great a portion of its water, which is so necessary to vegetation. We see in dried turf, when cut for fuel, the effects produced by depriving it nearly of all its water. Its particles, by coming into closer contact, proportionably lose their affinity for water; so that by steeping turf, once dried for a long period, in cold or even boiling water, no change is produced in its solidity. If broken small, and mixed with water, it loses that tenacity which it had originally, and is rendered incapable of being kneaded into a paste.

Hence it will be necessary to make sluices in some of the principal drains, to keep up the water for promoting vegetation, as well as for the use of cattle; by which means the water may be disposed of according to the pleasure of the cultivator.

The water may be occasionally kept up by sluices.

Some of the drains and rivers may be converted into navigable canals, for the purposes of conveying limestone, gravel, clay, and other manures into the bog, by small floats, capable of holding four tons, which may be pulled by men through the water, while the bog is yet soft, and unable to sustain the weight of horses.

Canals.

I have laid out some lines for new roads in this district, which will be of permanent advantage to the country, and serve for the purposes of conveying manure to the interior of the bog, and carrying out the future produce when reclaimed.

New Roads.

Reclamation.

The occupiers of the upland adjoining the bogs throughout the district, have of late years made various successful attempts towards reclaiming the verge of the bog contiguous to their land; their efforts have been attended with advantages beyond their most sanguine expectations. Those who have short leases discontinued the process, which has prevented large tracts of bog from being under tillage, or converted into pasture; however, they remain convinced of the value of bog as a soil.

The occupiers of the upland adjoining the Bog, have reclaimed some parts of the Bog edge;

but those who have short leases discontinued the improvements.

But where the work has been pursued by such of those gentlemen as are proprietors of the bog, we find a different scene take place; and the face of the country completely changed, from a wild and useless waste to ornamental plantations, or luxuriant meadows and pasture grounds.

The Proprietors who have reclaimed their Bogs have changed the appearance of the country.

All the rivers or streams running through the bog, form valleys, whose sloping sides become somewhat consolidated, naturally yielding good grass without any preparation whatever, except setting fire to the surface in dry hot weather, by which means the heath and moss are destroyed, giving way in the following season to a spontaneous growth of grass, on which cattle feed at all seasons, but seem particularly desirous of it in summer, probably from the cool and moist nature of the soil being grateful to their feet; some of these valleys produce good hay by very little attention or trouble: The extent of this natural reclamation (if it may be so called) is generally proportioned to the magnitude of the river, being from two to eight perches in breadth.

Grass valleys in the Bog

The manure which has been found to answer best for reclaiming bog, is limestone, gravel, and clay, which may be had in abundance at every part of the bottom of bog, as well as its edges, and in the islands; it being as (I have already mentioned) the upper stratum of which the country is composed.

Manures:
Limestone, gravel, and clay.

Marl is sometimes used, and has been found to answer well; but of this there are several varieties in the district; the best containing about 80 per cent. of carbonate of lime. However, I cannot discover that it has been much used on the bog; but from such as have used it, I am led to understand that it is not by any means as productive as the gravel, nor have I learned it has ever been used in the vicinity of this district on the upland soil.

Marl.

Lime is sometimes used as a top dressing on firm Black bog, which generally gives a good crop; but it is not considered as a profitable manure, in consequence of the facility with which its very fine particles are washed deep into the porous peat by heavy rains. Peat ashes are found to be very productive as a top dressing on bog, and are also considered as valuable on upland soil.

Lime.

Peat ashes.

Stable or farm-yard manure, very deservedly holds the highest rank in the class of manures; but from its scarcity it is always mixed with gravel or peat ashes, or both; with this composition the bog gives abundant crops of oats, rape, flax, hay, potatoes, cabbages, turnips, &c.

Stable and farm-yard manure.

Black peat is used as a compost or upland soil; when mixed with lime, mould, dung, or scraping of roads, it is found of essential use.

Black peat.

The system pursued for reclaiming bog is generally the same throughout the district. The first year, during the summer months, drains are cut, so as to consolidate the bog, previous to any further advances; the following summer paring and burning takes place, the process of which is as follows: the surface sod which consists of many varieties of moss, grass, heath or fibrous peat, is taken off to the depth of some inches; the spade, hoe, or plough are used, according to the solidity of the bog or the thickness of the sod to be pared. When the surface consists of a light covering of grass and moss on Black bog, the hoe is employed; when it is composed of moss and fibrous peat on wet bog, the spade is used; and recourse is had to the plough, if the bog should be firm enough to bear the weight of cattle. As soon as the paring becomes sufficiently dry, it is mixed with a small proportion of clay and gravel, and is formed into conical heaps, about four feet high, and is set on fire under the influence of the atmosphere. During this process, a great part of the carbon of the vegetable is involved in a gaseous form, along with the hydrogen and other volatile products, and the mass loses at least seven-eighths of its weight. The loss of carbon may not be considered as of much consequence when the ashes are to be used on bog, which abounds in that substance; but for upland a slow combustion would be preferable.

Mode of reclaiming Bog.

First year drains are commenced, and when the Bog becomes sufficiently solid, it is pared and burned.

Paring.

Burning.

Carbon and hydrogen are involved

The value of ashes as a manure is estimated according to the weight and colour; the heavy reddish or brownish coloured being considered the best, from its containing a larger portion of oxyd of iron with lime and alumine; the quantity varying in proportion to the specific gravity

The heavy red ashes from Black Bog are of more value than the white ashes from Red

Bog, which are of little value as a manure.

gravity of the peat: the black compact sort yielding a greater proportion than the spongy red Bog, which gives light ashes of little value as a manure.

Mode of improving spongy Red Bog;

When consolidated by draining, it may be grazed by young cattle;

then pared, burned and coated with gravel;

and laid down with grass seeds; when the peat becomes sufficiently decomposed it may get a second coating of gravel to prepare it for a rotation of crops.

The best method of treating spongy red Bog, after it is consolidated by draining, would be, for the first two seasons, to let young cattle on it from March to September; they would eat the young heath (of which they are particularly fond) along with the grass which grows on its surface. At the expiration of this period the Bog will be in better order and more solid, from the treading of the cattle, and the decomposition which will have taken place by the loss of its superfluous moisture; it may then be pared and burned, and get a coating of limestone gravel of about 500 loads per Irish acre (each load weighing about six hundred weight), which should be lightly ploughed in, and laid down with grass seeds, under which it may lie until the peat should be decomposed to such a degree as would prepare it for a second coating of gravel, to fit it for potatoes and a succession of crops.

Method of reclaiming Black Bog, or cut out Bog.

It may be pared and burned, giving it an even surface, and laying on 1,000 or 1,500 loads of gravel per acre; then plough, harrow, and open drills for potatoes, laying on 250 loads of stable dung.

The produce nearly equals the expense.

Then oats may be sown and laid down with clover and hay seeds.

It is grazed for some years, after which it is broken up again.

The above process was tried by Mr. Smith, and has succeeded well.

Firm black Bog, or cut out Bog, may be reclaimed by paring and burning, giving it a regular and even surface, and where practicable an inclined plane, taking care not to leave any partial rises or swells on the surface, which are apt to become spongy and bad. This may be prepared immediately for a succession of crops, by laying on from one thousand to fifteen hundred loads of gravel to the Irish acre, which should be lightly ploughed in, and harrowed; then opening drills for potatoes, lay on about two hundred and fifty loads of stable dung. The average produce of this crop nearly equals the amount of the expenses of reclaiming. After this potatoe oats may be sown, and laid down with red clover and white hay seeds, which also give a good crop; the grass in the stubble may be eat off by sheep. The ensuing season being kept for meadow, it gives a good crop of hay, and it is then grazed for some years, after which it is broken up again, undergoing a similar treatment. This process has been tried on a considerable extent of Bog in this district, by Mr. Smith of Racket Hall, and in each instance turned out advantageous and profitable. He informs me, "he has no doubt that, by ploughing and trenching on narrow ridges, the two following years would have produced "good crops of oats; but at present he has only proceeded so far as the meadowing "and grazing. However, he means to try the trenching of oats;" after this the process of manuring should be repeated.

As the result of long experience must be considered of importance, I have annexed estimates of the expenses and produce of an acre of potatoes, cabbages and turnips, drawn from the practical knowledge of Mr. Smith.

Estimates of the expense of improving an acre of Bog, with potatoes, cabbages and turnips.

Expense of improving an Irish Acre of Bog, with Potatoes, after draining; viz.

	£.	s.	d.
1,500 loads of gravel, including levelling, at 2 *d.* - -	12	10	—
Spreading - - - - - - - -	1	—	—
Ploughing - - - - - - - -	—	13	—
Harrowing - - - - - - - -	—	6	6
Opening drills - - - - - - - -	—	6	6
250 loads of dung, at 1 *s.* - - - - - - -	12	10	—
Moulding, twice - - - - - - - -	—	13	—
Ploughing, digging out, picking, &c. - - -	2	—	—
Seed - - - - - - - - - -	2	—	—
Sorting and sending to market - - - - -	2	10	—
	34	9	—
Produce, 120 barrels of potatoes, at 20 stone per barrel, or 3*d.* per stone - - - - - - - -	30	—	—
Deficient of the first expense, besides rent - -	4	9	—
The same expense for cabbages - - - - - -	34	9	—
with additional labour - - - - - -	5	11	—
	40	—	—
1,200 heads may be raised; a great waste must be in heads, splitting, decaying, &c. to feed cattle or sheep; allowing one-fourth to be lost, the remainder may be worth 1 *d.* per head - - - - - - - -	37	10	—
Deficient - - -	2	10	—
Turnips, less expense, say - - - - - - -	28	—	—
This being a more uncertain crop than the other two, and much depending on the use they are applied to, besides the fluctuation of markets for sheep and cattle; an acre will do well to make - - - - - -	11	7	6
Deficient - - £.	16	12	6

"This

The foregoing estimates are made for Red Bog, but on Black Bog the expense would be less.

" This calculation is made for red Bog; should black Bog be worked on, one-third of " the gravel may be spared; the dung also can be dispensed with, as the black Bog, well " gravelled and ploughed deep, will afford ashes sufficient."

Method of reclaiming as practised by the poorer classes of farmers.

Among the poorer classes of farmers, after burning, they generally lay on four or five hundred loads of gravel, with the ashes, and from fifty to one hundred loads of dung; after which they take off two crops of potatoes in succession, before they sow oats.

Fiorin Grass.

Reclaimed Bog produces excellent crops (at least equal to the upland) of potatoes, oats, rape, flax, turnips, cabbages and celery; and answers extremely well for all the different kinds of grasses usually found in the adjacent upland soil; particularly white and red clover, white hay grass and rye grass. The white clover grows spontaneously after gravelling. " Mr. Smith has tried the fiorin grass on four acres of reclaimed Bog, which were planted " in October 1809, but had made no great progress until the spring of 1811, when it " appeared in a more promising state; this may be owing to the unusally dry spring of 1810, " together with want of attention in covering the strings; but wherever it has met with " moisture it seems to flourish."

Irrigation.

Several parts of the district, where the streams of the upland may be conveyed on the surface of the Bog, are well adapted for irrigation, and the water may be taken across the drains in wooden troughs at a small expense.

Planting.

Upwards of 200 acres of Bog are planted in this district.

The trees appear healthy.

Scotch fir the most abundant.

Trees grow on Red Bog 20 feet from the clay or gravel.

Within these few years, upwards of two hundred acres of Bog, in different parts of this district, have been planted with trees of different ages, from two to ten years; consisting of Scotch fir, spruce fir, larch, oak, ash, alder, birch, hazel and timber sallow: almost all of which appear healthy, and promise to do well. The Scotch fir is the most abundant in proportion. Some of those trees are planted on wet red Bog, twenty feet from the gravel, others on compact black Bog, fifteen feet in depth; and some have had a few shovels full of gravel thrown under the roots, when planted on the light spongy turf, which evidently answers better than being without it.

On firm Black Bog trees grow as well as on upland.

Those trees that have been planted on firm black Bog thrive as well as the same species on upland. Mr. Lidwell of Dromard planted some larch and Scotch fir eleven years ago, and they are now as good as any trees of the same age on the upland in the vicinity.— " Messrs. Birch of Roscrea have planted about seventy acres of cut out Bog, and wet red " Bog: the former are thriving as well as the generality of plantations on upland; the " latter they have only commenced on last season; and the numbers which have missed are " not by any means unusual." The Reverend Mr. Grady of Littleton, Mr. Lalor of Cranna, and Mr. Lalor of Killoran, have also planted a considerable number of young trees on different parts of the Bog, the greater part of which are growing well.

REP. III.—Mr. *Aher*, on a different District in Queen's County; observations on drainage, reclamation, crops, &c.; plants natural to Bogs; analyses, &c.

On Drainage.

Drainage.

The falls for drainage of these Bogs are considerable.

Very deep drains will not be necessary.

IT will appear by the foregoing descriptions, that the falls from the surfaces of the Bogs towards their several outlets, are very considerable, and that there is in general sufficient fall for the drainage of the under strata, as well as the surface; this circumstance is mentioned only as a proof of the great falls which these Bogs have, but at the same time it must be observed, that they should not be drained to such an extent, as to deprive the Bog of too great a proportion of its water, which is absolutely necessary to promote vegetation. In this district, where the Bogs are much detached, it will not be necessary to sink any deep main drains of the first class, such as have been proposed for District No. 8, as the rivulets or streams which pass through or border these Bogs are adequate for all the purposes of such drains.

Description of proposed drains.

The drains which I shall recommend as best suited to these Bogs, are similar, and retain the same name as those of the second, third and fourth class of drains, as described in my Report on District No. 8, the dimensions of which are as follow, viz.

2d Class - - 12 feet wide at top, 1 foot wide at bottom, and 9 feet deep.
3d Class - - 6 feet wide at top, 1 foot wide at bottom, and 6 feet deep.
4th Class, or surface drains, 3 feet wide at top, 9 inches at bottom, and 3 feet deep.

The drains are laid out in the shortest direction to the outlet.

These are stated as the average dimensions upon which the calculations in the estimate are made; but in the execution of the work, the drains in the interior of the Bogs must necessarily be sunk to a greater depth than at the edge where they communicate with the outlet. The lines of these drains are generally laid out in the shortest direction from the summit of the Bog, to the most convenient outlet for effectually carrying off the water.

2d class drains; where used, and their distance asunder.

3d class drains.

4th class, or surface drains.

The drains of the second class are to be used principally in the wettest and deepest Bogs, and are placed at the distance of 40 perches, or two hundred and eighty yards asunder; but where the Bog is more firm or shallow, the drains of the third class are introduced either solely or alternating with those of the second, being parallel thereto, and still preserving the distance of forty perches asunder; and the fourth class or surface drains are to be sunk in two directions, namely, midway between, and parallel to the other drains, and also at right angles

angles thereto, at the distance of 20 perches asunder, which would, with the assistance of the other classes of drains, divide the Bog into squares of 2½ Irish acres each.

The distance of the surface drains may be varied.

This system will be sufficient for draining the wet Red Bogs; but near the edges, where they are more firm, the distance of the surface drains may be varied according as circumstances will allow; but in the estimate, I have charged them according to the regular system above described.

Drains with sloping sides are best suited to spongy wet bog.

Drains with sloping sides are best suited to spongy wet Bog, and by being made narrow at the bottom they give an increased velocity to the stream, which tends to keep them open and free of obstructions; but in firm Bog, shallow drains, with perpendicular sides, may stand for a considerable length of time. On Bog of this description, the occupiers sometimes leave passages across the drains uncut, and excavate small tunnels underneath, for the passage of water; bridges of this kind are sufficiently firm to admit cattle to pass over them.

Method of cutting drains.

In sinking these drains, the mode of proceeding should differ according to the nature of the Bog to be cut through. The excavation near the verge of the Bog should be made to the full dimensions in the first instance, if it be sufficiently firm to admit it; but in the wet parts of the Bog in the interior, where the drains cannot be sunk at once to the full dimensions, they may be excavated to the depth of three or four feet, which would cause the Bog to subside against the following season, when the work should be resumed, by sinking a few feet farther, and thus continuing the process until the drains shall have been sunk to the stated depths, as recommended in my Report on District No. 8, where a plan for cutting drains has been given.

The drains should be frequently scoured.

Sluices may be erected where necessary.

The excavated peat should be removed and burned.

The drains would require to be frequently attended to, and kept open by scouring as often as may be found necessary, until the Bog, by subsiding, shall have become perfectly consolidated, and when they are finished, it may be found necessary to erect sluices in them at various places, either to prevent the Bog from too great a loss of water, by which vegetation might be retarded, or to raise it near the surface for the use of cattle. The peat which has been raised in excavating should be removed from the deep drains, so as to prevent any weight or pressure on their loose soft edges, which would tend to close their sides and choak them; and where opportunities offer, it may be piled in heaps and burned to make ashes for manure.

The Bog near the verge will become firm before the interior.

In the progress of sinking those drains, it is evident that the edges of the Bog, and the parts adjacent thereto, will become firm and consolidated long before the interior parts. Hence the cultivation may commence on those parts immediately, without waiting the completion of the general system of drainage.

Observations on the wetness of Bogs.

To ascertain whether the wetness of these bogs originates solely from rain-water falling on the surface, or from springs in the interior of the Bogs, or from both, is an enquiry of very great importance, and deserving serious consideration, as the system of drainage should be regulated thereby: if for instance, it is supposed to originate from rain-water only, shallow surface drains would be sufficient; but should it be found to originate from springs rising up through the Bog, a system of deep drains calculated to intercept and convey the water of those springs to the most convenient outlet, should be adopted.

Annual fall of rain and dew;

how disposed of.

Towards arriving at a knowledge of this interesting subject, it might not be amiss to ascertain the probable quantity of water which annually falls, and how that quantity is disposed of. We find from experiments that the average fall of rain and dew in this country, amounts to about thirty inches; and the manner in which we are left to account for the disposal of this quantity is, by the formation of rivers, by evaporation, and by supplying plants with nutriment.

It is evident, that the quantity of rain which goes to supply rivers, must depend on the inclination of the surface on which it falls; the greater the inclination of that surface, the greater will be the portion of water discharged into the rivers.

That Bogs discharge a great quantity of rain-water from their inclined surfaces, is evident from the sudden swellings of their streams and rivulets, which have no connection with the upland: what this quantity may be, is uncertain; but if we judge from the circumstances of the Bog being already completely saturated with water, as well as every other appearance connected with it, we would be induced to suppose almost the entire of the rain which had fallen on the Bog was discharged into the river, and that a very small portion, if any, remained for evaporation.

Annual evaporation.

We also find, that evaporation alone from a surface similar to that of wet Bog, is sufficient to expend a portion nearly equal to the entire amount of what falls by rain and dew annually. If a surface of water is exposed to the action of the atmosphere, about thirty-six inches will be evaporated annually; and from a surface of moist earth covered with grass, a quantity equal to twenty-five inches will be evaporated annually.

Now a great portion of the Bogs of this district being so completely saturated, may be said to expose a surface of water to the action of the atmosphere, while the remainder may be considered as moist earth and grass; consequently the evaporation therefrom would nearly equal the annual fall of rain and dew.

Bogs appear to be supplied with water from

Hence it appears that the Bogs must be supplied with water from other sources besides rain and dew, and this supply can only be from springs rising within them. These springs are frequently visible at the summits, where innumerable small pools of water are met with, divided from each other by a very wet soft kind of peat, through which the water is readily allowed to filtrate. As the surfaces of the water in these pools are all on different levels, the highest must part with its water to the next lowest, and so on in succession; and so the highest pool invariably preserves the surface of its water on the same level or nearly so, during the continuance of the driest seasons; it must follow that it is supplied by springs beneath it.

springs at their summits.

Reclamation:

Reclamation.

The cultivation of the Bogs in this district has not been carried on to any great extent, as is already mentioned in treating of each division, but generally limited to some detached parts at the Bog edge, where it has succeeded equal to the expectations of the cultivator.

Manures.

The manures generally resorted to, and which are found by experience to answer best for reclaiming these bogs, are limestone gravel, marl and turf ashes.

Limestone gravel.

Limestone gravel consists of rounded limestone pebbles of various dimensions, mixed with calcareous earth and clay; it gives a considerable degree of firmness and stability to the peat soil, and is considered the best manure for its improvement; it may be obtained in abundance near the borders, and at the bottom of the bogs in every part of the district.

Marl.

Marl is found in some parts of the district, but has not been much used on the Bogs, or even on the upland; the proportion of lime it contains is variable..

Turf ashes.

Turf ashes, as a manure, have been generally esteemed as possessing very valuable properties in proportion to the weight and colour, the heavy red kind being considered the best; their action on compact peat is a proof of the quality they possess in promoting vegetation on that soil, and there can be but little room to doubt of their having similar effects on upland; but of turf ashes, there are several varieties; the best kind met with in this district contains lime, gypsum, silex, magnesia, alumine, and oxyd of iron, in variable proportions; the white light ashes are obtained so very sparingly in proportion to the quantity of peat burned, that they are not sought for as a manure.

Quick lime.

It does not appear that quick lime has been much used as a manure on any of the Bogs in this district; however it may be applied with advantage on well drained compact peat, which it dissolves in proportion to the quantity used; it would not be advisable to use it on fibrous Bog, because the minute particles of the lime would descend too low into the peat, to render its effects beneficial to the surface.

Sand.

Sand which is partly silecious and partly calcareous, may be obtained in the beds of the principal rivers and streams of the district; it has not been used as a manure on any of these Bogs, although it may be applied with very good effect.

Process of cultivation.

Paring, burning, &c.

The process of cultivation after drainage, is similar to that which I have explained in my Report on district No. 8; namely, paring, burning and coating the surface with limestone, gravel and clay, in various quantities, at the rate of from five hundred to fifteen hundred loads per Irish acre, each load weighing about six hundred weight. In some places paring and burning only is resorted to, which is a cheap method of reclaiming black Bog, and succeeds extremely well.

Part of Aghaboe Bog improved.

In the Bog of Aghaboe, a luxuriant growth of grass is produced by spreading the ashes on its surface, without the addition of any other substance; but the most permanent improvement would be effected by clay and gravel, in addition to the ashes.

A simple mode of improving Red Bog.

A very easy and simple mode of improving red Bog is sometimes had recourse to by setting fire, in the very dry weather to the vegetable surface, where it is firm enough to bear the weight of light cattle; this has the effect of destroying the strong rank grass and small branches of heath, without destroying the roots, which throw out young tender shoots the following spring, on which the cattle appear to feed with eagerness.

Where the rivers or streams pass through the Bog, they form narrow vallies, whose sides produce good grass, on which cattle feed for a great part of the year.

Crops produced on reclaimed Bog.

The reclaimed Bogs of this district produce excellent crops of potatoes, oats, rape, flax, turnips, cabbages, parsnips and celery (and in one instance barley) with various kinds of grasses, particularly the meadow soft grass, fiorin grass, and purple meelic grass; the two latter grow spontaneously on dry fibrous red Bog, as well as on the cut out turbary; white clover is also frequently met with, thinly scattered on the surface of compact black Bog.

The difference in the depth of reclaimed Bog does not seem to have any effect on the produce of its crops.

Rotation of crops

The best rotation of crops for these Bogs appears to be the following:

First year - - Potatoes or rape.
Second year - Oats, laid down with hay seed and white clover.
Third year - - Meadow, after which it may be used as pasture for some years.

Sometimes two or three successive crops of potatoes, as also oats, are taken off without any additional manure; however it would be advisable to add a small quantity of gravel for each crop.

An Irish acre of Bog may be gravelled an inch thick for £. 8. 12.

The bog being previously drained, may for the foregoing succession of crops, by covering its surface with gravel an inch in thickness, being at the rate of three hundred and sixty tons per Irish acre, which with the assistance of portable rail roads, may be laid on the surface for £. 8. 12*s.* per acre, as will appear by the following estimate; viz.

Digging and filling 360 tons of gravel, at 2*d.* per ton	£. 3	—	—
Drawing from the gravel pit into the bog, 360 tons, at 2½*d.* per ton	3	15	—
Spreading the same, at ⅓*d.* per ton	—	15	—
Cost of railway and waggons	—	10	—
Wear and tear, and removing	—	7	—
Damage to gravel pit	—	5	—
	£. 8	12	—
Draining, as per estimate annexed	1	17	9
TOTAL expense of draining and gravelling an Irish acre of bog	£. 10	9	9

being at the rate of £. 6. 9*s.* 6*d.* per English acre. The bog, thus improved, will be worth from 25 to 35 shillings per Irish acre.

Planting.

Planting on bog may be carried on successfully to a very great extent; the principal kind of trees which are found growing on the bogs, are fir, alder, birch, beech, hazel, sallow, and holly, all of which appear to thrive as luxuriantly on well drained compact peat of any depth, as on the upland soil; if there is any difference, it is too trifling to be observed.

Scotch fir and birch are frequently found growing in wet situations, on deep soft bog, but not as healthy in appearance as that on compact bog; to fit the latter kind of bog for planting, nothing more is requisite than keeping it tolerably well drained; but soft Red bog, besides draining, requires a few shovels full of clay and limestone gravel to be thrown about the roots, and this simple preparation is sufficient.

List of plants which grow on these Bogs.

The following is a List of the principal Plants, which grow spontaneously on these Bogs; viz.

Spagnum palustre, or bog moss; this seems to constitute the principal part of the peat.
Hypnum, or feather moss.
Polytrichum, or hair moss.
Bryum.
Lichen rangiferinus, rein deer moss.
Lichen pyxidatus, or cup moss.
Scirpus caespitosus, dwarf club rush,
Anthericum ossifragum,
Juncus, bufonis, toad rush,
These plants are found in great quantities throughout the district, and form mattings or tufts on soft wet bogs. The Scirpus caespitosus, which is called by the peasants keeve grass, flourishes best in very wet parts of the bog, where its long and slender roots may be traced to the depth of two feet.
Erica vulgaris, common heath.
Equisetum limosum.
Lemna, or duck weed.
Conferva.
Equisetum arvense.
Scoenus mariscus, bog-rush.
Mentha sylvestris.
Hypericum pulcrum.
Vaccinum oxycoccis, or cranberry.
Empeticum nigrum, or crowberry.
Myrica gale.
Arundo phragmites, common reed grass.
Eriophorum Angustifolium, narrow-leaved cotton grass.
Holcus lanatus, meadow soft grass.
Milica caerulea, purple melic grass,
Agrostis stolonifera, fiorin grass.
These two grasses are very general in the bogs, and are found growing together.

The vegetation of moss seems suspended in very hot weather.

Peculiar property of the Sphagnum, or Bog moss.

The vegetation of such mosses as grow on the bog, seems to be suspended during the hot summer months, when they appear parched and withered, but their roots remain preserved by the water in which they are immersed. Mosses possess a power of absorbing moisture, and retaining it for a great length of time, particularly the sphagnum, which is also endued with the peculiar quality of retaining its vitality for several months after it has been separated from its roots, and it is enabled to resist putrefaction for a great length of time.

Description of a turf bank, exhibiting three successive growths of trees.

In the bog of Clontyglass, adjoining the townland of that name, the turf banks exhibit three successive growths of trees, the roots of which, with part of the stems attached to them, are found remaining undisturbed from the original situation in which they grew, a drawing of which is annexed.

The first or oldest growth is in contact with the gravel, the stems and roots occupying a space of eighteen or twenty-four inches in height; they are separated from the second or middle growth by a stratum of very compact black peat, called stone turf, three feet in thickness; the roots and stems of the middle growth, extend about four feet in height, over which there is a stratum of fibrous peat of a light brown colour, about eighteen inches thick; on this a third growth appears, not more than about two feet in height, and is covered with moss, grass, rushes and heath, for about nine inches in depth; the stems of this growth are sometimes visible above the surface.

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The stems or trunks of the first or oldest growth of these trees, being from ten to twelve inches in diameter, are saturated with water, and completely uninflammable; the wood is so soft, that a trunk may be easily cut through by a spade, and the entire of its composition is so altered, except the bark, that the species of tree is scarcely discernible, yet the bark that remains still attached to the trunk, appears to be uninjured by time.

The second or middle growth of trees, which are the largest of the three, have their stems about eighteen inches in diameter, at about twenty inches from the root; they are in a high state of preservation, and retain a great degree of inflammability; some of the trunks are found lying horizontally near the roots, but the former are by no means as numerous as the latter.

The third or surface roots, which are perfectly sound, have all the appearance of a recent growth, yet no tradition remains amongst the oldest inhabitants of the neighbourhood, of the existence of those trees in a living state; they appear from their dimensions not to have attained a great age, the diameter of the stem being from four to five inches.

Turf cutting.

In cutting turf, it frequently happens that on going to a certain depth, the accumulation of water prevents the workmen from proceeding down to the gravel, they are therefore compelled sometimes to leave six or eight feet of the best kind of turf untouched after them, which lies next the gravel; this might be remedied, by attending more particularly to the drains which should be continued up to the turf banks on a level sufficiently low to take off the water from the surface of the gravel; but where this is not practicable, it would be advisable to keep the drains on as low a level as circumstances would allow; by these means a greater quantity of the best kind of fuel would be obtained.

Turf banks are subject to break down, for want of sufficient drains.

Turf banks are often subject to break down, for want of sufficient drains to carry off the water; it would therefore be advisable to sink back drains, parallel to the general outline of the banks, which would intercept the water from the interior of the bog, and prevent those accidents to which they are frequently exposed.

Roads.

The public roads of that part of the country in which this district lies, are generally well made, and kept in excellent order; in some places I have proposed to connect those roads by new lines running across the bog.

Roads through Bog.

These roads I would recommend to be thirty feet in breadth, and placed between two parallel drains, at the distance of twenty feet from each side of the road; by this mode, the expense of a number of bridges may be avoided, which on deep bog would be considerable; and the drains at that distance on each side, would help to consolidate the road, and prevent the water from sapping its boggy foundation, which very frequently happens.

These roads may be laid out, but should not be gravelled until the year following the completion of all the drains in the bog, the surface sod will then have become solid, and form a strong support to the gravel.

Navigable drains.
Portable railways.

From the nature of the bogs in this district, and the manner in which they are detached, the introduction of navigable drains would not be attended with any essential advantage, and must evidently fall short of the utility of portable railways and waggons, as recommended by Mr. Edgeworth.

Bog Bridges made of timber, &c.

Bog bridges, as they are termed, are of two kinds; one consists of a few pieces of timber (usually found in the bog) laid horizontally across the drain, and covered with heath or brushwood, over this are laid sods which are covered with gravel; if the bridge is intended to be permanent, this kind of bridge may be rendered very efficient, if the materials are strong. The other kind, which is made only on compact firm peat, is formed by leaving a passage across the drain uncut, and hollowing an archway through it at the bottom for the passage of the water; this kind, it is evident, could not be formed on a soft bog.

Another kind.

Mill Streams.

It will not be necessary to make any alteration in the mill streams of the district, or to reduce their present supplies of water; on the contrary, those supplies will be augmented by the proposed drainage. The river Nore affords several good sites for new mills.

Analysis.

Analysis:

Analysis.—Twenty-four cubic inches of compact blackish brown turf, recently cut from a turf bank in the bog of Abbeyleix, weighed 6,544 grains; being left in a warm room twelve days, was reduced to 13 cubic inches, and in weight to 1,640 grains, which produced 320 grains of charcoal, containing 4 cubic inches; 2,000 grains of this turf well dried, gave 100 grains of yellowish red ashes, which were found to contain,

Carbonate of lime - - - - - - -	35	parts
Gypsum - - - - - - - - -	31	
Carbonate of magnesia - - - - - -	3	
Silex - - - - - - - - -	13	
Alumine - - - - - - - - -	10	
Oxyd of iron - - - - - - - -	8	
	——	100 parts.

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Another specimen of ashes from the same bog; contained,

Carbonate of lime	61
Gypsum	22
Silex	8
Alumine	5
Oxyd of iron	4
	100 parts.

100 grains of red turf ashes from Aghaboe bog; contains,

Carbonate of lime	21
Gypsum	6
Silex	25
Alumine	26
Oxyd of iron	22
	100 parts.

Another specimen of ashes from Aghaboe bog; contained,

Carbonate of lime	27
Gypsum	9
Silex	26
Alumine	21
Oxyd of iron	17
	100 parts.

Sphagnum or bog moss was boiled in distilled water constantly for six days, and on being decanted, the water was found to contain sulphuric acid, with a very minute portion of gallic acid and tannin; the boiled sphagnum did not appear to be much altered in its texture.

Water expressed from turf cut on the bog of Abbeyleix, contained sulphate of lime (gypsum) in solution; but did not contain either gallic acid or tannin.

I have subjected several varieties of clay and marl, found under these bogs to analysis, the results of which have given very different proportions; viz.

Marl from Aghaboe bog; contained,

Carbonate of lime	85
Alumine	7
Silex	8
	100 parts.

Marl from Cullena Bog;

Carbonate of lime	46
Alumine	32
Silex	22
	100 parts.

Blue clay from the Bog of Toger; contained,

Carbonate of lime	11
Alumine, coloured by oxyd of iron	70
Silex	19
	100 parts.

Blueish clay from Ross Bog; contained,

Carbonate of lime	26
Alumine, coloured by oxyd of iron	62
Silex	12
	100 parts.

Some unforeseen circumstances have prevented me from concluding a number of experiments on the nature and properties of peat, particularly on charred turf, and its application to the smelting of ironstone, which is found in great quantities in the vicinity of Castlecomer, where the remains of several furnaces are visible; these iron works were carried on to a very considerable extent at a former period, when the country abounded with wood, but have been discontinued in consequence of the scarcity of fuel of that description.

I hope soon to be able to lay before your Board the result of these experiments.

I have the honour to be, &c. &c.
D. Aher.

REP. III.—Mr. *Colburne,* on the Bogs in the west of the County of Clare; general observations on drains, &c.

Mr. Colburne, on the Bogs in the western part of the County of Clare.

In cutting the main and cross drains, I would give three inches slope, or better, to the perpendicular foot on the sides, making a surface drain five feet deep, four feet wide on the top, and one foot six inches bottom breadth; the main drains ten feet deep, seven feet top breadth,

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breadth, and two feet in the bottom. The wetness of the bog might occasion a variation in the dimensions of the main drains; but generally, I think a slope of three inches to the foot will answer the purpose. I have seen many Bog drains with nearly perpendicular sides, that have stood well. The turf banks are cut nearly perpendicular, and they seldom slip, though frequently of considerable height, and not always cut down to the substratum, commonly with a deep drain at the foot where the turf has been cut out, which does not fill with water until the wet season, except where there are springs. Very few of the main drains in this district will extend ten feet deep; and to that depth they can be bottomed, by casting up the Bog-stuff with a light casting-tool; and no benches or off-sets on the sides will be necessary.

Where new roads are to be made, merely for the convenience of the Bogs, the expense of making them will fall on the reclaimer, and is estimated; but these roads need only to be gravelled ten feet wide. Where the new roads form useful communications with the surrounding country, they will be done by presentment.

Where cultivation has followed the partial drainage of Monmore Bog (on the southern edge next Kilrush, principally, and some few acres near Dunbeg,) the mode adopted is generally similar to that practised in other counties; viz. to dig or plough up the surface of the drained Bog; gather it in heaps; and having mixed some clay with it, (which is got in the bottom of the drains of the shallow bog, or from the adjoining lands,) they set it on fire in dry weather, and the ashes being strewed on the bog, it is again ploughed or dug, and prepared for sowing rape, which I am informed is generally productive. The next crop is oats, and afterwards potatoes, if they can obtain sufficient manure for a crop, otherwise they continue the oat crop until they have sufficient manure collected to bear potatoes. There is no limestone or limestone gravel in this part of the country, so essential to the improvement of waste lands; but the sea-sand and the sea-weed are here in great abundance, and are esteemed excellent manures, and are taken a considerable distance inland, particularly for potatoe crops, and would be invaluable on Bog (where effectually drained) mixed with a portion of clay, and a light top-dressing of lime.

No regular system having, as yet, been put in practice for the draining of any of the Bogs in this district, it is no great wonder that such a project should be treated as chimerical by many who have only observed small patches reclaimed with difficulty, or a few shallow drains cut through large wet Bogs, and left to collapse and fill up for want of occasional scouring and deepening. The result would be very different, if a regular system was steadily pursued, and all, or most part of the drains necessary were opened at once; the main drains gradually cut to their proper dimensions; the cross drains kept open, and to their proper depth, until the Bogs had gradually acquired a tolerable degree of firmness. This, it is true, would require a great number of drains in the wet parts, particularly the summits, which are the wettest parts of the Bogs; and cutting the drains through them at first will be difficult and tedious; but by using proper instruments it can be done reasonable, and the very wet parts will become the best land, from the subsidence of the great quantity of vegetable matter (of which these wet parts or quagmire is composed) getting into a putrid state, and producing a rich manure. The sods cast out of the drains will of course be burned with the first surface heaps.

With respect to the future value of the reclaimed bog, if the drainage were carried into effect in this district, I should conceive that the value would be increased at least seven shillings per acre per annum; and on that supposition I should make the following calculation, leaving a large portion of the district out of the account, such as Turbary, in convenient situations, and now partially drained, and some firm pasturable Bog, and only calculate on the wet and at present useless parts of the Bogs, which contain about 12,000 Irish acres, at seven shillings per acre, making £.4,200 per annum. The estimate for the drainage is £.31,728. 12*s.* 6*d.*; but suppose it to be £.42,000, it would be 10 per cent on the money laid out, and is a fair calculation, on the supposition that the Bogs should be invested in the Commissioners, and let on leases, suppose of thirty-one or forty years (after the drainage was complete), at the expiration of which it would be a great property. And I have no hesitation in saying, that the exportation of corn from this country would be equal (in a few years) to supply the deficiency in England, and be a material benefit to both countries; besides giving employment to the peasantry at their houses, and preventing emigration, or the alternative, starvation. The failure in the prosecution of canals, has rendered it necessary to provide some other public works for the employment of the people; and where that can be done without increasing the national burdens, is an object worthy the serious consideration of the Legislature. In Scotland, in one district, from fifty to seventy thousand pounds annually (for several years past) has been granted by Parliament, for the very laudable purpose of executing a canal (the utility of which is yet to be ascertained,) avowedly for the purpose of giving employment to the people there, and preventing their emigration. This is exclusive of the liberal grants for roads and bridges in Scotland, which is considerable every session.

REP. III.—Mr. *Brassington*, on Bogs in Kildare and King's county; general observations, legislative views, &c.

Mr. BRASSINGTON, on the Bogs between Kildare, Athy, and Monasterevan.

I AM of opinion, that however unsatisfactory all conjectures may be as to how Bogs were originally formed, that the essential difference between Bogs consists in their having or not having soil in their composition; and, as I conceive, the essential difference between Bogs, when contrasted the one with the other, to consist in this, so am I disposed to think, that the difference in solidity and colour, which is observable in different parts of the same Bog, is produced by draining alone; for where the water can be removed by draining, the substance of the Bog which had been dilated by the water, collapses, and being also compressed by its own weight, to which the Bog, whilst undrained, gives resistance, it becomes solid and dry in different degrees from the bottom to the surface, proportionate to the pressure its different parts may have sustained, and the extent of the draining, and necessarily exhibits different shades of colour, consequent upon the different degrees of solidity and dryness.

All the surface drains should be of the same depth and dimensions, viz. the depth of seven feet, and the breadth of eight feet six inches above, and of one foot six inches at bottom. The depth and dimensions of the main drains vary according to the different depths of the Bog; but they should all agree in this; the being sunk to the very bottom of the Bog, without which, in my opinion, any attempt at draining the Bog must be idle and ineffectual.

With a view to the cultivation of the Bog, I should in the first place mention, that there have been no experiments of any consequence made in the reclaiming and improving of Bog in this neighbourhood; the only Bog reclaimed being small spots here and there, which the poor cottagers of the country have endeavoured, as well as they could, to make conducive to the support of their families. The method they uniformly pursue is, after having manured the Bog with a compost formed of turf ashes, the dung of their cowsheds, and the scrapings of the roads, to plant in the first year, a crop of potatoes; and in the two following years, either oats or rye; and the result of this mode of cultivation, if any instruction or inference can be drawn from the merits of a plan, where the means of the persons who conduct it are limited and insufficient for the purpose, fully corroborates the opinion I have before ventured to give, as to the impolicy of using drained Bog for any thing but meadow or pasture; for the corn crops these poor people have are miserably deficient in the quantity and size of the grain, and though with the last crop of corn, grass seed is sown, the grass, owing to the exhaustion of the soil, does not thrive for more than a year at the very utmost.

In fact, the only crop, except grass, at all adapted for Bog reclaimed by draining merely, and which is not cut down to the bottom, is rape; but this could not possibly be cultivated on Moanavullagh Bog, as it requires ashes of turf mixed with clay, which turf could not be procured on this Bog, owing to its great depth, without an expense greatly exceeding the possible profits of a rape crop.

And I conceive, that in cultivating grass, which is the only crop, as I have often observed, adapted to this Bog, the process of irrigation, as tending to the support of vegetation, and by its weight to the compression of the Bog, upon which its improvement essentially depends, and also to prevent the Bog from cracking from dryness (and nothing is liable to become drier or more arid than a drained Bog) would be highly beneficial; nay, without it, I should apprehend, that the Bog would not, for a series of years, become sufficiently compressed and improved, even with the assistance of the top dressing hereinafter recommended, to produce and support any useful vegetation.

The first thing to be done towards preparing the Bog for receiving the grass seeds which it is intended to cultivate upon it, should be perfectly to level the different compartments on it, formed by the intersection of the different surface drains; in this process the irregular heathy hillocks, and different decayed aquatic grasses, together with the stuff taken out of the drains, should be collected in heaps; these heaps should then be burnt and their ashes spread on the Bog.

After the Bog shall have been so manured with ashes, it should get a top-dressing of limestone gravel, here called corn-gravel, which from experience I have found to have a greater tendency to originate vegetation, and lastingly to support it, than any other dressing a Bog can receive; and in procuring the limestone gravel to be mixed with marle, or to be used alone, care should be taken, where there is a choice, to select that which has the greatest portion of clay in it.

And in manuring the Bog, a ton weight of manure should be allowed to every square perch, independent of the ashes spread on it. When the Bog shall have been so manured, it will be fit to receive the grass seed, which should be sown upon it in the month of September, and it should be covered over with the brush-harrow; but after this nothing should be done till the next spring, when as soon as the weather will permit, it should be rolled with a large sized roller, both to level the surface more perfectly, and to afford a landing and additional covering to the grass, and immediately after, in the same spring, it should undergo the process of irrigation. The depth and dimensions of the trenches to bring the water over the Bog, must depend on the subsidence of the Bog, and it will be necessary of course to construct troughs for its conveyance over the drains; but I am certain, from having found timber, while boring in various parts of the Bog, as well in the interior as upon the edges, that the Bog will afford an ample supply of timber, both for the troughs and bridges, which it may be necessary to throw across the drains in different parts.

What description of grass may be best adapted to this new made soil, I am unwilling to give an express opinion upon; but I would recommend, with a view to ascertain this fact, that a trial, upon a small scale, of various kinds be made, particularly of the fiorin grass, so much recommended by Dr. Richardson, who has written a treatise on the reclaiming of Bog, and on the culture of this grass.

The consideration of the foregoing subject has led me to contemplate the utility of an act of Parliament, that would embrace for its object, not only the Bogs, but the low wet lands, which cover so extensive a part of the surface of Ireland, a few observations on the drainage of which, cannot be considered irrelevant to the object of your present enquiries. That such an act would be a matter of considerable importance to the interests of Ireland, must be obvious to any person whose pursuits in life are anywise connected with the viewing or management of land. I have had frequent opportunities of observing grounds, where hundreds of acres were inundated for perhaps six or eight months in the year, which could be effectually remedied by the expenditure of a sum that, contrasted with the object of improvement, must be regarded as inconsiderable.

Frequent instances are to be found, of industrious and improving land-owners, well disposed to contribute their portion of capital to improve the properties of themselves and neighbours, by straightening the course of such streams and rivers as cause the flooding of their grounds, or by removing such obstacles as may increase the floods; but for the want of co-operation of their poor, or perhaps slothful neighbours, such improvement is altogether prevented. Often you may find ill-chosen mill-sites, eel-weirs, &c. as before observed, erected, in innumerable instances, in flat low countries, where the course of the river is naturally sluggish, and where the erection of weirs frequently hold up the waters to such a height, as to injure the lands above them, frequently to the amount of one hundred times the annual value of the mills or weirs which occasion the inconvenience. Such mills and weirs were permitted to be erected in times when the comparative value of land was inconsiderable; but now the increasing population of the country, and the increasing export of provisions to Great Britain, and the consequent increase in the value of land, call forth every exertion to reclaim and render productive not only the Bogs, but also those extensive tracts of bottom or low lands throughout Ireland, which are at present bad pasturage, or (from the floods) uncertain meadow; all which, in the event of drainage, would become some of our best tillage and meadow grounds, and would undoubtedly increase to considerably more than double their present value.

To carry into effect the drainage of any proposed district, the first object would be, to ascertain, under the direction of the Commissioners, the extent of grounds injured, and the proportion belonging to each proprietor, and the increased value which would be given to each estate, in consequence of the drainage.

The variety of tenures under which lands are held, and the number of derivative interests subsisting in many cases between the landlord in fee and the occupier of the soil, present an obstacle to the measure, of raising at once off the lands to be drained a fund for the purpose; as the different persons entitled to an interest in prospect (though not in possession) would be unwilling to advance their proportion of expense; but a fund might be created by a Parliamentary loan, or one made under its authority, for that purpose, the interest of which might be paid by an annual tax on the lands drained, proportionate to the benefit received. By these means, every person entitled to an interest contributes his proportion to the general expense, according to the advantages derived by length of occupation, until it reverts to the landlord in fee, in whom there might be a power to discharge the principal sum. To allow in like manner a power of redemption to the present Proprietors of Bogs, on paying the expense within a limited time, would afford, in my humble opinion, the means of effecting their drainage; for the Commissioners will be pleased to keep in their view, that neither of the great and desirable measures, of reclaiming the Bogs, or draining the marshy grounds of Ireland, can be fully or beneficially effected, without the interference and support of the Legislature.

I have the honour to be, &c. &c.
R. Brassington.

REP. III.—Mr. *Jones*, on the District of Lough Corrib; successful method pursued at the Bog of Monivae; General Observations.

Mr. Jones, on the District of Lough Corrib, in Galway and Mayo.

IN a letter written by the late Mr. French, of Monivae Castle, to the Dublin Society, in January 1769, he describes different methods he pursued to reclaim part of this Bog immediately adjoining his dwelling-house. He began the work by making a new and straight

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channel for the river, which ran within a few yards of his house, and then stopping up the old course, and cutting drains into the new river.

The first method he pursued was, by covering the surface of the Bog with limestone gravel, then laying a coat of dung over it, and planting potatoes upon the dung; the next year he sowed oats or rye, and grass seeds, and the following year mowed the produce; the Bog was so wet, that he was obliged to cut several small surface Drains, which were afterwards filled up when the Bog became firm. To lay the gravel on the Bog, he made roads with hurdles, on which the horses walked, carrying gravel in baskets on their backs; the hurdles were removed from place to place, as occasion required. This Bog, Mr. French mentions, subsided from 15 to 20 feet. After the first crops were taken off, and mowed for two or three years, little tufts of heath began to appear in some parts; these parts he tilled again, and spread dung upon others; but lime effectually banished them, and so did a mixture of kelp and ashes, the refuse of a bleach green, which proved the richest manure; river mud was also spread on one or two acres, which had little effect, only producing a sedgy spiry grass, until dung was laid over it; marle had somewhat a better effect than the river mud, but marle mixed with dung proved very good; lime, dung, or kelp, broke into fine powder, proved the best. Mr. French also reclaimed above an acre by gravelling and laying a coat of fresh lime over the gravel, and planting potatoes on the lime, without dung; the potatoes were small and lay thin, when dug out, but the corn which succeeded them proved very good, and the Bog was thereby well reclaimed. Mr. French tried to reclaim part by burning the surface, but the Bog was red and spongy, and the ashes produced were white, and so light, that it was of little effect. Another method that Mr. French pursued in reclaiming Red Bog, was, when it was pretty dry, after being drained, he laid two or three inches in thickness of dung on the surface of the Bog, without gravel or any other manure under. The crops of potatoes, corn, and meadow following, were full as good as where the gravel was first laid on. In wet Bogs, Mr. French recommends, that gravel should not in the first instance be laid on it, on account of its specific gravity having a tendency to press and sink through the surface into the soft pulp; but when the Bog has been mowed for two or three years, then he advises the gravel to be laid on; when dung is to be had in plenty, Mr. French is of opinion, it is the best material for reclaiming Bog; but he thinks that composts made of lime and earth mixed, or lime and moor, may answer the end of dung; but of this he had not sufficient experience.

The expense of reclaiming an acre of Bog, Mr. French computes to be from four to six pounds; but this expense must naturally increase with the further extension of the improvements into the centre of the Bog.

By the adoption of the above modes, the late Mr. French reclaimed about 32 acres of red and flat moory Bog; and the present occupier, by the further improvement of it, by irrigation in the summer months, has enabled his cattle to graze off three successive crops of grass.

The principal drains made by Mr. French were usually 10 feet wide, but their depth depended on local circumstances, the part reclaimed being from 12 to 18 feet deep, and in some places deeper. Mr. French reclaimed about six acres of the Red Bog by spreading gravel alone on it; this he never tilled, but reserved for pasture; it is far inferior to the tilled Bog, and would not become meadow until covered with other manure, and again tilled. Where gravel was thrown on the sides of the new river, to be carried to the surface of the Bog adjoining, Mr. French planted clumps of spruce, fir, birch, and alder, all of which grew well. The broad-leaved elm, which is interspersed through the meadows reclaimed from the Bog, also throve well.

The present Proprietor, following the steps of his predecessor, has also reclaimed about 30 acres, in addition to the above.

Between the house and the river, the late Mr. French planted some larch; there was only from eighteen inches to two feet deep of firm moory soil, the under stratum of which was manuring gravel. These trees are remarkably fine, some of them being from 40 to 50 feet high, the trunks of which would square from 20 inches to 2 feet.

As the bogs in general in this district are pretty firm and not very deep, the principal drains being made from 8 to 12 feet in depth, will, I conceive, be found sufficient to reduce them to a consolidated state, so as to receive agricultural improvements.

As it has now been pretty well ascertained, that bogs when sufficiently drained and reclaimed are peculiarly well adapted to the growing of green and white crops, and flax, and also of almost all descriptions of forest and ornamental trees, I should presume that they would also be well suited for growing hemp. Although it has been very generally thought that bogs could not be effectually reclaimed, so as to be cultivated in less time than 8 or 10 years, yet in numerous instances in this district, they have been brought to profit in less than half that time. On the edges and in some of the islands in these bogs are numerous and very populous villages; and although there is but little tillage in comparison, on account of the great quantity of rocky ground adjoining, very little has been done by the tenants in the way of improving. This is principally owing to the want of encouragement, by their getting only short leases, &c. Were the peasantry duly encouraged to promote agriculture, they would yearly reclaim several acres of these bogs, which are so well circumstanced for improvement, by spending that time at it, which is so frequently occupied in annual emigrations.

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REPORT III. Mr. *Bald*, on the Bogs in Mayo; general Observations, &c.

General nature of Bog.

BOG is formed of vegetable matter, with some small part generally of earthy metallic and saline substance. In the lower strata of bog the vegetable matter is formed in a state of decomposition; in the higher strata, in a state of rixney; and on the surface, in a living state, unless when drained or cut away for turf. In this country bogs are formed of flag plants in the lower strata, and of moss plants afterwards, with different admixtures of decomposed leaves, and the small branches and bark of wood; the larger parts of wood (consisting of oak, pine, yew and willow) being still found in a recent state. They are all in a semi-fluid state, from the water they contain, and which is the support of the moss of which the bogs are principally formed. The cause of bog may therefore be fairly presumed to be the obstructions given by the inequalities of the ground, or the falling of trees or other substances, to the free passage of the water, supplied either by springs or by rain, affording the proper food of the flag and moss plants of which it is formed.

Its cause.

Its improvement

As the effects cease with their causes, so to give a perfect free passage to the waters from the substratum of bog, must destroy the food of the flags and mosses, produce their consequent death, decomposition, and formation into vegetable mould; which, in its progress, can be easily increased by periodical flooding with water, and drying by mechanical mixture, by paring and burning the surface, by the addition of other recent vegetable matter or animal matter, by the application of lime in its caustic state of limestone, or other gravels, or any earthy or stony matter, or by all these means at different times, or any of them most suited to the situation of particular bogs. When reduced to a state of vegetable mould, without the addition of any earthy or stony matter, bogs are capable of producing luxuriant grass both for pasture and meadow, potatoes, turnips, cabbages, rape, flax, oats, barley, and rye, in abundant crops; also timber trees, and, I do believe, hemp; but having no positive certainty of the fact, only offer my belief.

Capable of producing when mere vegetable mould.

Dr. Patterson, on the climate of Ireland, page 185, mentions, “ that near the extremity of this peninsula, ascending the lofty mountain of Lough Salt, a few years past, stood a very respectable wood, directly facing the north-west; and from this place through a space of some miles westward, in a rough mountainous country, several woods were growing on exposed heights within these forty years.” Page 188, he says, “ the trees in Kilderry, the oldest of which were planted prior to the year 1711, grow in a soil whose upper stratum is improved peat, and whose under stratum is either gravelly loam or a sea mud; they are situated in a flat space of ground, very much exposed to the south-west gales, which come forcibly upon them over the course of the broad river Foyle, and a considerable vale of at least five miles in length. General Hart, within these three or four years, has planted above 30,000 trees of various kinds; some of them in moory ground, without breaking up the general surface, but merely by opening holes, and mixing clay with the peat; afterwards keeping them firm, by surrounding them with the sods cut off the surface of the holes.” Page 194, he says, “ In the county of Antrim, trees thrive in lofty bleak mountain situations. At Fairhead, the most northern extremity of Ireland, and exposed to the fury of the north sea; the mountain ash, beech, oak, with other indigenous trees, grow luxuriantly within 15 or 20 yards of high water mark. In every other part of the coast, where land is of the same form, viz. very high, it is covered with thriving wood; but when the surface is nearly level for a length of way inland, no wood appears; and not a hedge is seen to rise higher than the top of the bank that protects it from the wind. Amongst the rocks on the east face of Agnew Hill, the aspen tree grows luxuriantly at about the elevation of 1,450 feet, and on the top of Sleive Mish, at the height of 1,390 feet, the mountain ash flourishes in the face of every storm.”

The plantations made by the late Marquis of Sligo (on a healthy and exposed hill, with the upper stratum chiefly composed of peat, eastward of the town of Westport, without any previous preparation, are in a remarkably thriving state, and composed of larch, pine, and various other species of trees. Natural oaks grow on all the boggy hills throughout this district, alone kept down by the browsing and injury of cattle. Therefore all those bogs which rise to an altitude too great for the profitable cultivation of grain, can with even superior advantage to the public and the individual, be applied to the production of timber, by planting and fencing alone. By the addition of earthy or stony matter to this vegetable mould, a soil is produced of the highest possible fertility, and more easy and certain in all the operations of agriculture, capable of producing all the crops which our climate affords, with the single exception of wheat. Vegetable mould is well known to be the most truly valuable of all manures to the grounds of this country, and indeed of most others also. Bogs when perfectly drained become by the operation of time alone, and in no very considerable period, immense masses of vegetable mould, affording by their drainage the means of indefinitely increasing the productiveness of the present arable land of the country, while they add to its superficial extent that of their own contents.

Effects of the earthy or stony matter.

Valuable as a manure.

Lord Meadowbank, in a publication in the year 1802, mentions of peat moss, reduced to the state of vegetable mould by decomposition, and used as manure. “ Both the power and the duration of the manure have now stood the test of a great variety of trials, and considerable extent of ground, and of much variety of soil, continued without intermission the last six years. Hitherto it has been found equal and indeed preferable, to common farm yard dung, for the first three years, and decidedly to surpass it afterwards.”

General Observations.

At first view, a difficulty of procuring population for such an extent of cultivable land, added to the country might be feared, and indeed no country can, I believe, be found of similar climate to this, where the population is greater than the proportion to the quantity of cultivable land in which no extensive manufactories are carried on, and in truth the population having risen on the sides of the mountains to the height of 500 feet above the level of the sea, and descended on the very edges of the bogs until stopped by the wetness; and the constant division of the land amongst the families of the occupiers, and even to such small extent as not generally to leave at the present moment more than two acres and a half capable of arration to each family; and which may fairly be averaged, on the lowest computation, at five persons, giving, in a country almost purely agricultural, not more than one half acre capable of aration to each inhabitant living by the soil; little difficulty can be feared of the population at once rising to meet the additional supply of support to be derived from the cultivation of any possible extent of any cultivable land added to the country, were it even infinitely more extensive than the reclamation of the whole of the bog soil within Ireland would supply; and estimating according to the present rate of population to the soil, the drainage of this district would increase the population of the country above 46,000 souls. In the eminent work of Malthus on Population, (p. 336) he states "It has been universally re-"marked, that all new colonies, settled in healthy countries where room and food were "abundant, have constantly made a rapid increase in population," and reclaimed bogs in Ireland would have all the advantages of new colonies, both as to room and food in abundance, and none of their difficulties in distance and transport; and would therefore make a much more rapid progress in the increase of their population. (In page 349 of Malthus, it is stated) "other circumstances being the same, it may be affirmed that countries are "populous according to the quantity of human food that they can produce or acquire." I am therefore clearly of opinion, there can be no reasonable doubt entertained of the population not rising to the measure of the capability of the supply of food. Average rent. The average rent of the arable land throughout this district, I estimate at £.2 sterling, per Irish acre, by the year. Drains. I have determined the depth and nature of the different drains suited to each bog, so as entirely and permanently to effect its drainage, and fit it, when executed, for all the different purposes of agriculture, and to bear every description of stock; and the carriage out of the necessary manures on it, and its future produce from it.

Execution.

In the execution of these drains I would recommend the adoption of the very ingenious plan proposed by Mr. Griffith, in his first report.

REP. III.—Mr. *Townsend*, on the bogs in Tyrone, Armagh, &c.; general observations on the effects of existing acts of Parliament, &c.

Mr. Townsend on the bogs in Armagh, Tyrone, &c.

NOT being prepared to report fully on this particular district, I beg leave to offer a few general remarks respecting the reclaiming of bogs.

In order to make bogs effectually and permanently productive, a new surface must be created for vegetation; draining alone will not accomplish it, but ought rather to be considered an auxiliary step, subservient to the mode of cultivation, and not in all cases to precede.

The plan of cultivation should be determined on before the drainage is proceeded with; because, if properly managed, it will frequently supersede the use of drains: for if the surface of a bog can by any means be brought to such a state as to prevent the rain water from soaking into it, the effect is the same as to make drains for drawing off that soakage. There is no necessity to make any provision for taking away the springs in the substratum of the bogs, as those waters do not affect the surface. What may properly be denominated springs from the bowels of the earth, could not penetrate through such a tenacious substance of the thickness of the bogs in general, except their sources were at some immense altitude.

It has often been proved, that when any part of a canal is cut through a bog, there never is any leakage.

I have seen large reservoirs made in elevated parts of the country, constructed for the purpose of supplying a canal with water, where peat earth or bog stuff was found to be most efficacious for puddling and staunching the bottom, which happened to be porous.

There are swamps or flooded places in the bogs (I do not mean those parts that are flooded by the swell of a river or stream, but such places as are at times nearly covered with stagnant water) which require a fall or descent by cuts or drains, in order to let off the water in the same manner as any other marshy ground should be treated, by deepening the rivers or streams which are the cause of the injury. But the bogs are of a totally different nature to the swamps or marshy places that I am now alluding to, and require a different treatment.

If the entire surface of a bog was to be cultivated, the effect, I think, would be very different to that of only a small patch being reclaimed, which of course is almost surrounded by the pristine bog, and always receiving moisture from it. This is a distinction which, I conceive, is requisite to observe, because the steps to be pursued should vary according to the relative circumstances of each; a distinction which ought to be duly considered.

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It appears to me a matter of the utmost consequence to guard against extreme drainage, and to proceed with it cautiously, on whatever plan it may be adopted; otherwise there will be far more difficulty in procuring water hereafter, than in getting rid of that which at present lodges on the surface of the bogs.

Nature points out the mode of improving Bog; and although its progress is so slow, as scarcely to make any perceptible improvement in one generation, yet after a lapse of time, she accomplishes sufficient for an example for the industry of man to improve and benefit by. The specimens we meet with are on the banks of rivers or small streams, which come from the highlands, and run across Bogs. These are generally grassy as far as the floods happen to reach; clay, sand, &c. being carried with the stream in time destroys the moss; and the mud deposited along its banks, as the waters subside, forms a proper compost or mould for receiving grass and other seeds, fortuitously carried by the stream or the winds; and thus a very simple process by degrees changes the moss or Bog into pasturable ground, and a constant accumulation of clay makes a firm surface for cattle to walk on.

Irrigation, where clay or manure can be got to mix with the water, will improve vegetation; the small streams will perchance convey now and then a few grass seeds, and disseminate them in various parts of the Bog; these, with the assistance of particles of clay and mud, together with the peculiar properties that some waters have of promoting vegetation, will take root amongst the heath, and partial spots on the surface of the Bogs will assume a degree of verdure; other parts, where the clay and mud is not deposited in sufficient quantities, will perhaps give way to the increasing growth of moss.

In this operation the result will be tedious, and, in some instances, the effect uncertain; and it would be requisite to have persons constantly in attendance to regulate the distribution of the waters; it will not answer for any crop but grass, and it would be a considerable length of time before it could be brought to that state of perfection to admit of cattle grazing on it.

Fiorin grass, so highly and justly recommended by Doctor Richardson, will no doubt thrive in bogs. It certainly is a useful discovery, and may be cultivated to great advantage in particular situations; but I am of opinion, that so far as is applicable to the reclaiming large tracts of Bog, it may be considered more in the nature of a botanical or agricultural experiment than practically useful; for although this grass may grow in the middle of a soft bog, yet that Bog will not answer for producing any other crop, unless it undergoes a very different process of cultivation to what fiorin grass is said to require, and to which the mere planting of this grass will very little contribute, something more substantial being wanted. Therefore this mode of reclaiming Bogs will not admit of any variety in the crops, nor will it be suitable for grazing, because the cattle could not get footing; it might answer for meadow along the exterior edges, but in the interior of a large Bog, the difficulty and the expense of obtaining it would amount to more than the value of the hay.

From the many experiments made on a small scale by individuals, and from the information already before the Commissioners, there cannot be a doubt of the practicability of reclaiming bog; a surface dressing and burning, with a slight mixture of clay, will produce a crop or two; but it immediately begins to degenerate into unprofitable vegetation, and will not, like other lands, acquire renovation from rest. The grass which it produces does not afford nutriment to the cattle equal to the grass on upland, and the surface being tender will always be liable to break in holes under their feet, particularly in wet seasons; an evil that will every day increase, until the surface dressing is renewed, and another mixture of clay added, which will be requisite as often as the crop is repeated.

This seems an easy process, but it has seldom been carried to a degree beyond what was calculated on for one or two crops, in the most favorable places; near the upland, and perhaps where the peat has been partly cut away, the effect is not permanent; the same operation must be repeated as often as it is broke up for tillage, or the ground will be unproductive; it will therefore be necessary to consider how many repetitions will produce a permanent and perfect result.

I am of opinion that large tracts of red Bog will require a greater portion of clay than has generally been allowed to counteract the antiseptic properties, and in other respects make it fertile; the advantages will be much more substantial and the profits greater in proportion to the sum to be laid out, provided the process was to be carried to a greater extent, and perhaps this may be done on some plan that will not cause much augmentation of capital.

I will suppose one inch thick of clay or manuring gravel necessary to commence the cultivation after the surface is levelled and trimmed, which ought to produce two or three crops. Another half inch during the third or fourth year, and so on, that at the end of every three years there should be at least an additional half inch of clay or manuring gravel for the space of perhaps thirty years, at the expiration of which there will be five inches or more (because the turf mould will mix with it) of fine rich mould, upon the entire surface of Bog; it might then be classed with the generality of lands throughout the kingdom, and by continuing the same steps may become superior almost to the best land.

There may be difference of opinion respecting the precise thickness of clay which it is proper to lay on, but probably all will agree, that a deep rich-soil or mould will be most productive; the quality of the proposed lands will depend more on the quantity and selection of the materials they may be composed of than on the effects of draining.

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Five inches or more of gravel and clay could be laid on in less than thirty years, if it was absolutely necessary to complete it within a shorter period; but by bringing it in gradually it serves as a manure, and thus thirty or more successive crops of corn may be produced, the tillage constantly enriching the land; so that the last crop will be greatly superior to the first, the annual value of which will leave a considerable surplus over and above the expense of the improvements, together with paying a moderate rent, and in time a valuable estate will be created from unproductive wastes, and the capital repaid tenfold.

By steady perseverance and proper management Bogs may be improved, so as to be equal to the most productive lands in the kingdom; and I would advise, that a system of operations should, in the first instance, commence, with a view to attain so desirable an object, rather than to proceed upon a narrow limited scale, or such as would not afford the opportunity or means of bringing the Bogs to a complete state of cultivation, which when accomplished, the mode of farming may be left to the option of the occupier, as there will not then be any further actual necessity to continue the addition of manuring clay; but I think it probable that the farmers would still persevere in that system.

If this business should ever be proceeded with on the broad scale of a national concern (and it will hardly ever be made to answer on any other,) then a plan must be adopted, which will not only be suitable to the general purposes of reclaiming all the bogs in a substantial and perfect manner, but also to have a view to promote the interests of the country at large; otherwise, if left to individuals, every one will proceed upon such a plan as may suit his convenience, circumstances, and situation, but always labouring under some disadvantage, which could either be avoided, or at least would not be an obstacle on the large scale.

The conveyance of clay and gravel is an object of the first consideration, because on the application of these principally depends the successful issue of this important subject.

It is in some cases recommended to make roads and to bring the clay on cars from the nearest lands that will furnish it of a proper quality; this will be an expensive way of gravelling the bogs, independent of making and upholding the roads. A wet season would greatly retard, if not put a stop to the execution of the work, as a loaded car could not be moved off the gravelled road into a soft bog without further preparations.

Railways, either of cast iron or wood will greatly facilitate the conveyance of manuring gravel into the bogs, and for short distances will perhaps afford the cheapest conveyance.

Small canals and railways will afford every convenient necessary for completing the proposed undertaking, and will certainly be the cheapest system.

If navigable drains are to be made in any stage of the business, I would advise their being made in the first instance; and also to construct them on the plan of a connected system of navigation.

One obvious reason for commencing with canals, is the great advantage of conveying manuring gravel at a cheap rate, a coat of which must unavoidably be put on, that will weigh more than one hundred years production of the space it is spread on, even if a crop is taken off the reclaimed bog every year.

The most lucrative canals in England are those, where heavy materials are conveyed on them, such as coal, lime, limestone and manures; corn and merchandize in general form only a minor part of their revenue.

If it is not a connected navigation, the expense of cultivation will be rather increased than diminished, because boats and utensils must be provided for every separate bog, and must be built on the spot and taken to pieces again when they are done with; a boat that will carry 15 or 20 tons, cannot be removed by one or two men from one bog to another so readily, and it would be useless to leave it where only one limited solitary drain was navigable.

I have seen the experiment tried, of removing boats over land, and it was both too troublesome and expensive to be repeated.

A regular navigable communication will give opportunity for one set of boats to be brought to twenty different bogs or more, and when not wanted for that business, they may change their employment without the least inconvenience, as by means of canals, there will be an opening to almost any part of the kingdom, which consideration would encourage hundreds to build boats with a view to get employment in the bog improvements, and also for general purposes of trade; manuring gravel can be brought several miles if necessary in boats at a very easy expense, on which account, the choice of materials will not be limited to the nearest place, in case the stuff surrounding the bog should not be of a desirable quality; an advantage which should not be overlooked, because the future fertility of the bogs in a considerable degree depends on the selection of the manuring gravel or stuff to be laid on.

Should a general system of navigation be acted upon, it will not only afford the cheapest means of executing the bog improvements, but will essentially serve the country at large, by opening a channel for the easy conveyance of lime, turf, coal, corn and merchandize, contributing not merely to the improvement of the bogs, but to the improvement of every part of the kingdom, increasing the industry and wealth of the inhabitants, and will make the interior of the kingdom a kind of nursery for seamen.

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To proceed with the actual reclaiming of the bogs in Ireland will be an object of incalculable advantage to the United Kingdom, by adding upwards of a million of acres of fertile lands to the present agricultural produce of the Island, and thereby increasing the quantity of food, probably one-tenth or more, an object of the highest importance for the increasing population of the country; it will give employment to immense numbers of labourers, and afford numerous opportunities for farmers to exercise their industry and capital in improving their native soil, rather than emigrate to America, as hundreds do every year from Ireland, particularly from the north.

The Imperial Parliament will, no doubt, take the subject into serious consideration, and give all the encouragement that it may appear worthy of; and, as a national concern, perhaps there are few, if any, undertakings of a public nature more deserving Parliamentary assistance.

It will be a work of time and industry, and will require considerable capital to accomplish; however, by proceeding gradually and perseveringly with the undertaking, and considering the object to be attained, I think that a comparatively small grant would eventually answer the purpose.

I cannot form a near estimate of the quantity of bog throughout the kingdom; there are thousands of acres under the extent described by the present enquiry; but, taking it on a supposition to be one million of acres, which perhaps is rather under than over the actual quantity, the total sum at the first view appears so enormous, as seemingly to preclude the possibility of its being put in practice, for if we take the average of expense per acre for drainage and cultivation, at £.10, then the total sum will be ten millions sterling.

So prodigious a sum for such an undertaking may cause some persons to consider it a romantic scheme, and under that impression the bogs might for ever lie dormant; however, there is a more cheering prospect; for undoubtedly the first guinea to be laid out will become the source of a never failing accumulation of wealth; the final result of which will be the converting of unproductive wastes into an estate that will eventually produce a certain revenue of upwards of two millions sterling per annum.

The sum of about one hundred and twenty thousand pounds will be sufficient to reclaim all the bogs in Ireland, to be laid under the direction of Commissioners in such ways as the discretion of the Imperial Parliament may determine on ordering.

I will suppose that the Commissioners commence with reclaiming 4,000 acres of bog, which, according to a full estimate for cultivation, purchase from the present proprietors, and contingent expenses, allow to engage a capital of £.60,000, or one half of the grant.

They should also direct the first agricultural steps, and occupy the new lands for two years, at the expiration of which there cannot be a doubt it will let for from 15 to 20 shillings per acre; the total rent will then amount to from three to four thousand pounds per annum at the least.

This property, with the advantages of progressive improvement and consequent increasing value, would unquestionably sell for £.75,000, which sum the Commissioners will have an opportunity of raising by the sales of the first reclaimed bogs; whilst the second 4,000 acres is proceeding with and perfecting, so as to be disposed of in a similar manner.

By the sale of these 8,000 acres, the Commissioners, it is presumed, will have at least £.150,000 at their command, which will enable them to engage on reclaiming 10,000 acres, one half of which, at the before mentioned value, will produce from four to five thousand per annum, and at the same rate of sale, will make a sum of £.90,000; therefore, when 18,000 acres are reclaimed, the capital or stock will be worth one hundred and eighty thousand pounds and upwards.

Proceeding upon this computation, until one hundred thousand acres are reclaimed, the Commissioners would have a fund that will enable them to engage on 30,000 acres at one time.

Parliament will decide whether it will be prudent to continue this scheme beyond a limited extent, because if there should be any difficulty in meeting with purchasers, the new lands could not be sold to so much advantage; and even if they were sold satisfactorily, quere, whether the Commissioners could possibly proceed on such an augmented scale, with the future reclaiming and improvements.

I should therefore beg leave to suggest, that instead of making periodical sales of all the bogs which they may be enabled to reclaim, only to sell as much as will always keep a floating capital, equal to whatever sum the Imperial Parliament may in their high wisdom think proper to put at the disposal of the Commissioners, and that the acres undisposed of shall be let at a fair and equitable rent.

The revenue arising from the improved bogs remaining unsold, to be applied by the Commissioners to the further reclaiming of bogs, and either to be added to the original grant, or otherwise appropriated to perfecting the first rudiments of reclamation.

The increasing revenue and constant enlargement of the estate, will accumulate so rapidly, that the original fund will be swelling to an immense degree of wealth, beyond any thing

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that might be imagined from the present state and appearance of the bogs; so that independent of the general benefits which the United Kingdom will derive by the proposed measure of converting these extensive tracts of unprofitable wastes into productive agriculture, giving employment and subsistence to thousands, extending the beneficial effects of navigation through the Island, &c.; the nation will be amply repaid any grant that might be ordered by Parliament, and a very considerable surplus will be left at the disposal of government for any national purposes.

There is an Act of Parliament of the 5th of George the Second, chap. 9, intituled, "An "Act to encourage the Improvement of barren and waste Lands and Bogs, and planting of "Timber Trees and Orchards," in which it is enacted, that where there is an undivided bog or disputed mearing or boundary, any of the proprietors can call on the sheriff of the county to appoint a jury to examine into the claims of the parties within a limited time, whose decision is to be final and conclusive in respect to the division or allotment of each proprietor's share of the bog.

Should the bog improvements be entered into, this Act will be essentially useful, as there are great numbers of bogs where the boundaries of property are not ascertained.

After the extent and boundaries are settled, the Commissioners would probably proceed to a valuation of the bogs in their present state, and either to include the turbary, or let it be reserved by the present proprietors, with restrictions as to the cutting of turf or peat, not to endanger or obstruct the proposed works.

It will likewise be necessary to ascertain the value of those lands where clay, manuring gravel or limestone, is to be procured.

These valuations, to be determined by a jury impannelled by the sheriff of the county in which the bogs are situated, in the same manner as the value of lands are ascertained for canals and other public works.

Many hundreds of acres may be reclaimed without trespassing on the proposed funds of the Commissioners, if Parliament granted them the power of making leases to such persons as could be depended on, who would undertake to reclaim and cultivate particular parts of the bogs, paying an annual rent to the Commissioners, commensurate with the sum to be laid out, the terms of the lease, quality, situation, and local circumstances of the bog. The mode of improvement, quality of materials, &c. to be directed by the Commissioners, and expressed in the lease; there are numbers of persons residing on the borders of the bogs, who would be glad of an opportunity of cultivating considerable quantities on these conditions.

Before any improvements are began, it may be desirable that requisite portions of each bog should be allotted to the clergy or impropriators, in lieu of tithes. This apportionment might be determined either by a jury of the county, or Commissioners to be especially appointed by Parliament, or some plan similar to that which is acted upon in the inclosure of the fens in Lincolnshire. The present proprietors of tithes will then be fully compensated for their interest or claims in the bogs, and the improvements will be carried on in a more satisfactory manner, when freed from tithes.

EXTRACTS FROM THE APPENDIX TO THE FOURTH REPORT.

REP. IV.—Memoir of Professor *Wade*, on the Vegetable Matter of Bogs.

Memoir of Professor WADE on the Vegetable Matter of Bogs.

Sir,

Florinda Place, Lower Dorset-street,
December the 30th, 1811.

IN obedience to the wishes of the Commissioners appointed for the Draining of the Bogs of Ireland, communicated to me, through you, Sir, as their Secretary, "That I would favour them with a Statement of any Observations I may have made on the Vegetable Matter of which the Bogs of Ireland are composed, as well as on the Plants growing thereon; adding my Opinion upon the different sorts of Grain, or true Grasses, which I conceive best adapted for the crops upon the Reclaimed Bog; and any Remarks I may have made on the subject of the Reclamation of Bogs;"—

I have the honour of informing the Commissioners, that not having considered the subject ever maturely, in a national point of view, I have nothing material to offer, or perhaps worthy of their attention at present; my progress heretofore through certain boggy districts in Ireland, being merely to ascertain their vegetable produce, with a botanical intention.

In this point of view, then, necessarily limited, accompanied with a few Remarks, perhaps in some respects irrelevant and extraneous, and arranged under certain heads, I humbly offer, with very great diffidence, to the attention of the Commissioners.

Mosses,

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Rep. IV.
Professor Wade.

Mosses, Lichens, and Ferns.

Mosses:

It is well known that all boggy grounds are not only thickly covered over with mosses, but that in a half-decayed state, they in a great measure contribute to their solidity; for it is not from mosses alone that turf is derived; even whole trees form the composition of turf beds.

The Bog Moss *(sphagnum)* in its different appearances of whiteish yellow, rose colour, and green, appears to be the most predominant, and performs the chief share in the generating of Turf Bogs. The Great Golden-hair Moss *(politrichum)* seems to be the next. Many species of Feather-Moss *(hypnum)*; Thread Moss *(bryum)*; Spring Moss *(mnium)*; besides many other kinds, lend their assistance.

The geographical extent of mosses is very remarkable, and appears to be rather interesting. We find them on the southern sides of the most barren rocks; likewise in other sunny situations; on pure dry sand, on bare quartz, on rocks of porphyry and granite, on calcareous rocks, on slate, on gypseous soils, on the sides of pit coals, argillaceous soils, &c.; even rivers, brooks, and springs afford several species; and it is very remarkable, that they grow very luxuriantly on soils which contain iron ochre or marcasite. Mosses appear to require a much lower temperature, and a more rough climate than most other vegetables. Their most vigorous growth and propagation are in the spring and autumn: in low situations, they are seldom or never seen in the middle of summer, heat impeding their vegetation. It is observed that in polar regions, where the snow never thaws more than a few inches deep, mosses and lichens are the vegetable productions only to be met with.

It is remarkable, that the power of elongation, which is very striking in many of the mosses, which for the most part are perennial, does not so much belong to their roots as to their stalks and creeping branches; and I am inclined to doubt, whether any of the moss tribe are annual, and propagated by means of seeds only. The leaves of mosses never drop off at certain periods, but generally remain as long as the stalks and branches.

It is by no means the case, as generally supposed, that mosses impoverish the ground on which they grow; they grow best in barren places, and love cold and moisture, as before observed; hence they cover those lands with verdure, which would otherwise remain bare; and so far from injuring the plants which are found growing with them, they afford them protection, their roots penetrating to so shallow a depth into the ground, that they take from it little nourishment. Wherever a small quantity of grass is seen with mosses, there would be none without them; and if the land is drained and aptly manured, it will be seen that the moss is no impediment to the growth of the grass, for the moss soon disappears, and the grass flourishes.

Mosses retain moisture for a length of time without rotting, and from this quality, worthy of attention in many points of view; and it is singular, that no moss has been discovered, liable to the attacks of insects or worms.

The chemical analysis of mosses seems only to furnish some gummose and extractive matter, and combined with those, the gallic acid is found in some of them as our common Golden-hair Moss *(polytrichum)*; and from the known astringent properties of mosses, perhaps some of them might be worth trying in tanning. A considerable proportion of calcareous matter is found in some species of Feather Moss *(hypnum)*; and there is a species of moss *(targionia)* sometimes found in our Bogs, but sparingly, which on being cut into pieces, emits a strong smell of turpentine, a proof that it contains an essential oil; or in other words, that its proper juice contains carbonated hydrogen, from the diffusion of this turpentine-like smell.

Lichens:

Many species of Lichens are to met with in Bogs. The Rein-deer Lichen *(lichen v. bæomyces rangiferinus)* so called from the rein-deer living entirely upon it, and who constitutes the whole economy of the Laplander, is to be found in abundance on our heathy Bogs. The different species and varieties of the Cup Moss *(lichen v. bæomyces pyxidatus)* tipped with their beautiful and conspicuous scarlet tubercles, are likewise to be seen adhering to the turfy surface; as well as the Heath Moss or Lichen *(lichen ericetorum)*; the Ground Lichen, or Ash-coloured Ground Liverwort *(lichen canimus)*; and many other species.

Permit me to observe, that these apparently vegetable excrescences abound in every part of the world; the most barren rocks, in the very northern parts of the globe, are incrusted with them; the barest and hardest masses of granite and porphyry derive from them their first rudiments of vegetation. The Crisp Lichen *(lichen paschalis)* abundant on our high rocky mountains, has been found a very few years ago, near Mount Vesuvius, on a torrent of lava which issued in 1771, most copiously covering it, and appearing like hoar frost, with no other vegetable near it, and as it would appear, forming on the hard surface of the lava the beginning of vegetation. Many species are seen above 2,000 feet above the level of the sea; the barren surfaces of the masses of granite and porphyry of the primitive mountains, have peculiar lichens growing on them; indeed many prefer granite and porphyry rocks, on the hardest rock crystal, on mica, on sand stone, on basalt, on gneis, on marble, on shistus, calcareous rocks and old walls coated with lime, breccias and rocks of quartz, on arid heaths and mud, moist coarse clay, barks of trees, &c.; even in mines under ground,

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several species have been discovered. It may not be stretching the point too far, to observe, that many lichens, in a geological point of view, may afford land-marks for the detection of certain minerals.

The various economical uses to which many lichens are applied, merit much attention; such as in dying; most of them affording a considerable quantity of colouring matter, and which being merely extractive, is soluble in water, and obtained by simple infusion, which is fixed either by acids, urine or alum. By lime and ammonia, the colouring matter of lichens, if they have any, will be developed, or the process may be simplified by substituting sal-ammoniac for ammonia. Many lichens afford a gum by certain processes, as transparent and tasteless as gum-arabic, sometimes amounting to one-eighth of their weight. Some contain a considerable portion of the tanning principle; others afford medicine and food for man and beasts, as the eatable Iceland or Eryngo-leaved Lichen *(lichen islandicus vel citraica islandica)* to be found growing on our high mountains; the Reindeer Lichen, as noticed before, and many others.

Ferns:

A few species of the Fern tribe are to be found growing in our bogs, but only occasionally. In certain boggy districts, I have met with the Osmund Royal, or great Flowering Fern *(osmunda regalis)*; the Male Fern *(aspidium filix mas)*; the Female Fern *(aspidium v. anthyrium filix fœmina)*; common Hart's Tongue *(scolopendrium vulgare v. officinale)*; Northern Blechnum or Rough Spleenwort *(blechnum boreale)*; common brakes *(pteris aquilina)*; some species of the Horse-tail *(equisetum)*; common, and Fir-club Moss *(lycopodium clavatum,* and *selago)*.

In the cellular texture of ferns are found much crude oxygenated juices, containing a much larger proportion of saccharine matter than is usually found in other plants.

Several ferns are eatable, some foreign species in particular, containing a considerable proportion of saccharine matter, gelatine and mucilage; the inhabitants of New Zealand feed upon the roots of many of them, and in the East Indies the same part is used for food; our common Polypody *(polypodium vulgare)* rarely to be met with in our bogs, contains, besides, astringent extractive matter, in which the gallic acid is predominant; a great quantity of mucilage and sugar: the same constituent principles, but combined with resinous extractive matter, are found in our male fern, in brakes, in hart's tongue, &c.

In many of our common ferns, the gallic acid is so predominant, that an infusion of some of them, upon being added to a solution of sulphate of iron, or green vitriol, immediately produces a precipitate of a dark brown colour. The peculiar and often very intense smell diffused by ferns, when a fresh stalk is cut across, proves the presence of an essential oil, indicating thereby a combination of water and carbon, such as exists in aromatic plants containing essential oil. That ferns yield potash after combustion, is a circumstance well known; but they likewise furnish oil, or in its place, resinous extractive matter, combined with potash in such quantity, that the ashes of our common brakes made into balls, is used as a substitute for soap; that tannin, or the tanning principle, is also contained in ferns, appears from the use to which the roots of some of the common species I have mentioned, are applied by tanners.

The few chemical facts I have advanced with regard to mosses, lichens and ferns, and into which I have been led almost unknown to myself, from the importance of the subject, should be received by the Commissioners with caution and hesitation; coming more immediately under the observation of the able, industrious, and experimental chemist; I trust, however, they will have this tendency, to induce and court investigation.

Meadow and Pasture Grasses.

I have no doubt but most of our good grasses may be cultivated on reclaimed bog; some of them I have occasionally met with in bogs, in their unreclaimed state, as the White Hayseed Grass *(holcus mollis et lanatus)*; the highly valuable Cock's Foot Grass *(dactylis glomerata)*; the rough-stalked Meadow or Bird Grass *(poa trivialis)*; the smooth-stalked Meadow Grass *(poa pratensis)*; the Meadow Fescue Grass *(festuca pretensis)*; the tall Fescue Grass *(festuca elatior)*; the celebrated and fashionable creeping Bent Grass, or Fiorin *(agrostis stolonifera)* is known to be abundant in bogs. But the one I consider as the most valuable, in every point of view, is the Foxtail Grass *(alopecurus pratensis)*. I have never met with a single specimen in boggy districts; indeed it would appear likewise to be a very local plant; for if recollection serve me, many counties in Ireland are destitute of it.

The custom of sowing what are called common hay-seeds on any ground (in general the sweepings of hay-lofts, as introducing useless and noxious weeds) I must highly deprecate as a very slovenly method, and can tend to no advantage or permanent improvement whatsoever. The valuable and good hay-seeds, including darnel or ray-grass, with Pacey's variety *(lolium perenne)* can be easily collected by the hand at the time of hay-making, and sowed at the proper season, perhaps both in spring and autumn; indeed I conceive they cannot be sown too often *.

In a natural botanical arrangement of Grasses, wheat, oats, barley and rye are included. On their cultivation in reclaimed bogs, I cannot hazard any opinion; certain it is, however,

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* All the different species of Grasses may be seen in the Dublin Society's Botanical Garden.

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that oats have been cultivated with success on such grounds; and it is only by a well-conducted series of experiments, and rather on an extended scale, bogs varying so much in their composition, and I may add, their constitution, even in the same bog, that the successful cultivation of the other species of grain can be ascertained.

Artificial Grasses:

Under this head it will be sufficient to notice our red and white Clovers or Trefoils *(trifolium pratense et repens)*; St. Foin *(hedysarum onobrychis)*; Lucern *(medicago sativa)*; Chicory *(cichorium intybus)*; our common Vetch *(vicia sativa)*; and Buck-wheat *(polygonum fagopyrum)*. Other species of clovers, trefoils, vetches, and herbaceous plants, might be enumerated, as affording food for cattle, and thriving on reclaimed bogs, as the Hop Trefoil *(trifolium agrarium)*; Bird's Foot Trefoil *(lotus corniculatus)*; Trefoil, so called *(medicago lupulina)*; Bush Vetch *(vicia sepium)*; Tufted Vetch *(vicia cracca)*; Yarrow *(achilleamillefolium)*; Burnet *(poterium sanguisorba)*; &c. &c.

Red Clover:

We find is capable of being cultivated with success and advantage on all the more heavy and dry descriptions of land; and it is said to succeed on the deeper kinds of gravelly and sandy soils; it is frequently cultivated on deep bogs which have been cut out; and in certain districts in this kingdom, the chief top-dressings appear to be coal ashes and soaper's waste.

White Clover:

This highly valuable clover, so common almost every where, is said to be surprisingly encouraged and increased by merely spreading ashes of any kind over it; it is found to succeed well on the more rich and dry, sandy and loamy soils, as well as on all the clayey and turfy descriptions of land, where they have been well drained from moisture.

St. Foin:

The cultivation of St. Foin is hardly known in this kingdom, though acknowledgedly so important and useful. It is known to last very long on poor barren soils; and turf-ashes and soot appear to be the best manure for it. It is capable of producing a large product, even on the poorest description of land, and therefore worthy of being tried on reclaimed bog, for it is by no means confined, in respect to soil, as has been so generally supposed; but as calcareous grounds of every species seem peculiarly fitted to it, the occasional application of lime has been known to succeed admirably in promoting its quick and abundant growth; and further, a considerable degree of dryness is essential to the healthy vegetation of St. Foin.

Lucern:

This valuable artificial grass, cultivated with so much profit and advantage in many parts of England, as affording a quick and large produce of succulent green food for the support of different sorts of stock, and likewise hay for the winter fodder of horses and other cattle, is likewise hardly known in Ireland: whether it will succeed on reclaimed Bogs remains to be determined; but it is highly worthy of being tried on such grounds. The soils most suitable to its culture are those of the more deep, rich and drier kinds; as the sound, mellow, loamy, gravelly and sandy descriptions; but on such as are retentive of moisture, it is advised never to attempt it. Horse dung, in a proper state, appears to be the best manure for it; earthy composts, ashes and soot have been used, but they are npt to bring up the common grasses too much.

Permit me to make this general observation, sanctioned by the experience of the most intelligent farmers in England; that saintfoin will grow on gravelly and stony lands; clovers, on clays; and lucern, on light loams.

Chicory:

This herbaceous, succulent, stately perennial, is highly worthy of being cultivated, by way of trial, in reclaimed Bogs, for the food of cattle; we know it is capable of being grown on most of the loamy descriptions of soils, and even in some of the more light poorer kinds; but succeeds best in such as are not too retentive of moisture, though it has been found to succeed in a good strong wet loamy soil, sown with other crops; it defies drought in a remarkable degree; the most severe cold does not injure it; and to encourage us still further, chicory is known to thrive on any soil, if it comes up, as it may fail from a defect of seed.

Vetches:

Are known to be of the most infinite importance, either green or dry, in the feeding of horses, cows, sheep, and hogs; in short no artificial food is considered at this day equal to them. The prospect of their thriving in reclaimed Bog is, that in respect to soil, vetches admit of considerable latitude, growing on all the varieties without difficulty, from the thin gravelly to those of the deep and stiff clayey kinds, but certainly flourishes in the most vigorous manner on those gravelly loams that are not too moist.

Buck Wheat:

Is a crop not at all known in Ireland; but by good farmers in England is considered as very valuable for feeding horses, fattening hogs, and keeping poultry. They observe,

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that it is capable of being grown on most soils, provided they be sufficiently dry; thin sandy soils seem to answer well. Buck wheat is sometimes ploughed in as a manure with other succulent crops, a method far from being sufficiently practised or understood, as the means of obtaining rich vegetable manure; and in the practice it is suggested, that great advantages might be obtained by the spreading of lime or turf mould, and likewise ploughing them in. Quere.—Should a crop of buck wheat be tried on reclaimed Bog?*

Hemp:

It is now satisfactorily ascertained that hemp *(cannabis sativa)* can be raised on boggy grounds judiciously prepared, and becomes a valuable crop. In its cultivation, I would recommend a due mixture of male and female plants, should the saving of the seeds be one object; as without this mixture of male and female plants, the seeds will be unfertilized, and of course unproductive.

Flax:

Small patches of flax *(linum usitatissimum)* are frequently to be seen cultivated on the edges of Bogs.

Esculents:

Many are known to thrive well on boggy earth, or with turf-mould; as potatoe *(solanum tuberosum)*; the different varieties of cabbages, turnips, and cole *(brassica)*; carrot *(daucus carota)*; parsnip *(pastinata sativa)*, &c.

Shrubs and Trees:

Very few kinds or species are to be found growing naturally in Bogs; and to notice those of ancient timber, shrubs or herbaceous plants, which have been recognized by the different enquirers into the subject, in their fallen or semi-putrescent state, in the deep recesses of Bogs, occasioned by a variety of causes, does not, I conceive, come under my immediate enquiry or duty.

The sweet-scented gale, Dutch or bog myrtle *(myrica gale)* used in some countries instead of hops, and for tanning calf skins, is very abundant in many of our Bogs.

The marsh andromeda or wild rosemary *(andromeda polifolia)* is rather common in the Bog of Allen and many other Bogs; perhaps it is injurious to our sheep, who may have an opportunity of occasionally browsing on it; there is a species very common in North America, and there called broad-leaved moor-wort *(andromeda mariana)* the leaves of which have been found to be highly poisonous to sheep.

The delicate creeping cranberry *(vaccinium oxycoccus)* with its fair little assemblage of rose-coloured flowers, is likewise rather common in the Bog of Allen and other Bogs. The Swedes use the berries to boil silver plate to its proper whiteness.

The heaths to be met with in our Bogs, are the fine-leaved *(erica cineria)* the most common; the common erling *(erica vulgaris)*; and cross-leaved *(erica tetralix)*, which is by no means so common as the other two. I must not omit our truly indigenous beautiful species, the Irish, or Saint Daboec's heath *(Erica Dabeoci v. menziezia polifolia)*, so peculiarly common in the spongy, though not absolutely boggy grounds of Cunuamara, county Galway.

The common spreading willow or water sallow *(salix aquatica* of Smith) is the only species of this genus I recollect growing commonly in Bogs. It is well known that our indigenous species of sallows, willows and osiers, with a few exceptions, delight and grow luxuriantly in marshes and on the banks of rivers; and I have no hesitation in saying, that some of our best and most valuable species, as the common white willow or timber sallow *(salix alba)* the crack willow *(salix fragilis)*; the Bedford, Leicestershire or Dishley willow *(salix russeliana)*, the bark of which is considered so peculiarly good for tanning; and the common osier *(salix viminalis)*, may, under proper management, be cultivated in boggy districts.

Willow pollards are plamted with great profit by the sides of brooks and rivulets; and it is asserted by the most experienced planters, that they will grow in other situations with similar success, as wet and boggy grounds, &c.

It is observed that the red *(s. pagilis)* and white willow will grow well in all fenny situations, moor, or moss or wet or low lands, or any kind of clay, loam or mixed soils, but should never be planted on any high dry or burning lands.

The osier, as I observed before, delights in drained moors and the banks of large rivers; it has no dislike to being flooded occasionally, but seems to be invigorated by such irrigation. In the fens of Cambridgeshire, large plantations of osiers are raised with great success. The cultivation of the osier has been found to be very profitable on low lands, from being overflowed by floods, and which are often incapable of being applied to other uses, from the stagnant water converting them into a kind of swamp. Moderate moisture certainly is favourable to the production of fine trees, but water continually stagnant may be considered as ruinous, according to the best authorities.

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* The different artificial Grasses are to be seen in the Dublin Society's Botanical Garden, Glasnevin.

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Our common Sallow, or great round-eared Willow *(s. caprea)* is worthy of being noticed, though it in general prefers rather a dry than a very moist situation; its bark being of late recommended for the same purposes as the Peruvian Bark; and, in its green state, is used for making coarse paper and parchment.

The common Alder *(betula alnus)* flourishes in all our boggy and marshy districts; it is asserted, that if the Alder is planted in a low meadow, the ground immediately surrounding it will become boggy; and it is somewhat remarkable, that it will not thrive in certain descriptions of calcareous soils; its capability of living under water for a considerable length of time uninjured is well known, as well as the astringent properties it possesses, and therefore may be useful in tanning.

The Scotch Fir *(pinus sylvestris)* the only species of the whole tribe which can be considered as a native, appears to grow well in some boggy grounds; not that I have ever seen it in a state of great luxuriance in such situations. It may perhaps be unnecessary to mention, that the bark of the Scotch Fir is used in tanning leather; that most, if not all, of our old bogs are entirely filled up with the roots and stumps of this Fir, and that it should be cultivated in all waste grounds.

The common Larch *(pinus larix)* a native of Siberia, appears to thrive well in reclaimed boggy grounds; likewise the Norway Spruce *(pinus abies)* a native of the north of Europe.

Perhaps it would be well to ascertain whether the highly valuable Weymouth Pine *(pinus strobus)* a native of North America, which we are told often attains the height of above 200 feet, and has exceeded in multiplying itself, and that very expeditiously, by engrafting the branches on the trunks or stems of our common Scotch Fir, just noticed, would grow on reclaimed bog. Indeed, some other species merit our attention in this point of view, especially when we consider the attachment some of them have to the extensive swampy districts of cold and barren countries.

I have seen plantations of the Oak *(quercus robur)* on reclaimed bog; but they certainly had not that healthy and encouraging appearance as in other situations; and it is universally allowed, that the Oak thrives better on hilly than in boggy grounds.

It may not be amiss to state here what is so universally known and adopted in England; the superior advantage of propagating the species with sessile leaves and pedunculated acorns; that is, the leaves almost immediately growing on the branches, without the interposition of what are called petioli or leaf-stalks, and the acorns on elongated pedunculi or fruit stalks; this is what is called in England, the true British Oak for naval purposes.

On the propagating of Oaks in boggy grounds, it may be encouraging to remark, that many fine species are to be met with growing luxuriantly in a truly wild state in immense watery plains, or such as are occasionally exposed to inundations in North America; as the Water White Oak *(quercus lyrata)*; the swamp's Chesnut Oak *(quercus prinus)*; the live Oak *(quercus virens)*; perhaps one of the hardiest of the whole tribe, bearing the most rigorous seasons, and likewise the heat of the most scorching sun; the willow-leaved Oak *(quercus phellos)*, &c. &c. The "*Histoire des Chenes de l'Amerique Septentrionale*," by Michaux, is well worthy of attention on this subject; a translation of which has lately appeared, published under the auspices of the Dublin Society.

I have now, Sir, finished what I had to communicate to the Commissioners, for the present, on the subject of their enquiries, committed to my charge.

Should the Commissioners require a full catalogue of the different herbaceous plants, which are to be found growing wild in the Bogs of Ireland, I shall feel great satisfaction in complying with their wishes.

I have the honour to be, Sir,
Your obedient servant,
Walter Wade,
Professor and Lecturer on Botany to the Dublin Society.

Bucknall Marcarthy, Esq.
Secretary to the Commissioners for considering the practicability of draining the Bogs in Ireland.

REP. IV.—Mr. *Nimmo*, on the Bogs of Iveragh in the County of Kerry; Observations on the Formation of Bogs, on the Peculiarities of the same in a Mountainous Country; various Plans for irrigating, warping, course of Crops, comparison of Expense, &c.

Mr. NIMMO, on the Bogs of Iveragh, in the County of Kerry.

Reasons for adopting proposed works.

BEFORE proceeding to describe the works which I should recommend for the cultivation of these extensive wastes, it may not be improper to explain the grounds upon which my opinion of their efficacy is founded.

I have, in examining different parts of this district, taken some pains to discover what were the mechanical causes which facilitated the original formation of these extensive

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Mosses; and although my success in this has not been so great as to enable me to pronounce positively upon the formation of bog in general; yet, in many instances, I think I can yet speak with tolerable certainty, both as to the causes which have favoured their original production, and the means of obviating their present sterility. In this I have been anxious to discover, and follow the proceeding of nature, rather than to save the trouble of investigation, by adopting the opinions already formed on the subject.

Bog prevented from accumulating on banks of streams,

It is observable, that in all the rivers and streams which intersect these bogs, the accumulation of bog on their banks is prevented, and its place occupied by rich succulent pastures, at least in all places where the water runs with tolerable rapidity. Where, on the other hand, the stream is scanty and sluggish, the bog, whether the cause or the consequence of this condition, has grown into the water edge; but even then, the bog is shallow at the water side, in comparison of its depth a little way off.

not owing to fall,

Now the mere fall or slope is not the only cause of this, since the bog-soil in this country extends a great way up the mountains, or rather, I should say, to their summits. On quick slopes, indeed, the turf is thin, but not more than it is on the dry plains. From this, therefore, I conclude, that merely sloping the surface, were that practicable, without altering the supply of water on it, is not enough of itself for the perfect reclamation of a bog. This observation I conceive of importance, for it shows that there is, for aught we yet know, perhaps the same difficulty in the reclamation of mountain bog, as of those upon plains.

nor to drainage only;

Neither is the mere drainage the only cause of the grassy borders of the streams, since we see the edges of the turf-banks, although certainly dry enough, so far from affording pasture, are the most sterile spots that can be pointed out in the whole bog field. The edge of the banks of those streams, which cut deep in the soil, are also covered with heath only; and the same thing may be observed of artificial ditches or draining. In this last, however, we frequently see good grass on the stuff which has been thrown up from the bottom, and some time exposed to weather.

From this, therefore, we may conclude, that mere draining these bogs, or at least that deep draining, is not enough for their reclamation. The tufts and thin banks that frequently occur among the turbaries, are certainly sufficient drained, yet they are not more fertile than so many masses of cork.

still less to permanant moisture;

If we are not to ascribe the goodness of these pastures to their drainage, we have much less reason to account for it by the moisture which they enjoy. The interior of a shaking bog is wet enough, yet, though abundantly rapid in vegetation, it is of a kind which is either inaccessible or useless; but there is this important difference between the supplies of moisture in the two cases:—The bog is almost constantly gorged up with water, which passes off only by evaporation or a very gradual soakage, and is either pure rain water, or that which, descending from more elevated sources, has already been filtered through the strata, or the higher parts of the moss. The meadow is supplied with water only during floods; it passes quickly over it, carrying much sediment from the washings of the hills, and depositing it among the herbage; when the flood has passed, the meadow is quickly dry, but water is never far off the roots of the plants. The meadow is therefore irrigated; the bog is gorged or drowned.

but to irrigation.

Its effects,

The benefit of irrigation is supposed by some, to consist entirely in the mechanical effects of the water, as a carrier either of soil from the upper grounds, to be deposited in fine particles over the meadow, or of manure from farm yards or populous towns; and we have, to be sure, abundant proof of its good effects in this way. Others conceive, that the chemical properties only of the water are of importance; that it dissolves the particles of lime and other substances, and by corpuscular attraction parts with them to the vegetables or soils through which it passes, but that the water itself is no otherwise useful, than in so far as its decomposition furnishes that sap, and those gases, which are necessary for vegetable life, and that it is therefore chiefly of importance, when to be had, in dry summers, when the usual supply of plants is cut off by drought. Both parties are therefore particularly anxious about the quality of the water; the one, that it may bring with it as much manure or soil as possible; the other, that it may not bring acid, metallic or other solutions, and so tend to poison the plants, instead of nourishing them. But I think there is another point of view, in which we may conceive the very purest water to be useful to vegetation, provided it can be applied in sufficient quantity, and discharged at pleasure. The water, if so considerable as to reach the leaves of the grasses, may act by its detergent quality, in washing off their various feculencies, and promote the perspiration, and consequent health of the plant. In passing through boggy soil, it will tend to dilute and carry off the astringent principles, which otherwise check the decomposition of the vegetable matter. It will in like manner discharge those metallic and acid particles, which are considered as so injurious to the health of the living vegetable; and if the field be alternately flooded and laid dry, the coarser aquatics, as the sphagna, junci, holsi, &c. give way to those which are adapted to these alternate states of dryness and moisture; as the alopecurus, poa, festuca, and above all, the agrostis, or valuable "fiorin," so much recommended by Dr. Richardson, and well known as one of the most abundant in the watered meadows.

may be produced by purest water;

In this way, we may presume, that the irrigation of the bog-soil, where practicable, will always be attended with benefit, whatever be the nature of the water (excepting only when that contains in solution the deleterious principles aforesaid.) Even the water which has already passed through the bog, will be useful by its detergent quality; it can part with nothing

or even that of the Bogs;

nothing to one bog which it has already derived from another, unless we oblige it to do so by mismanagement in its application. This principle, if once established, will be particularly useful to us in our operations on the bogs; and the system itself appears peculiarly adapted to the situation of Ireland, where the peasantry are so active in the management of, and so much accustomed to the labours of the spade. In a grazing country, as this is, and is so particularly the case with the barony of Iveragh, the extension of the meadows is perhaps even of more importance than the increase of the corn culture. Though the harbour of Valentia is well adapted to the reception of ships of all descriptions, the effect it has hitherto had upon the agriculture of the district may be guessed at, from the circumstance of the bog growing down to the water's edge. Destitute therefore of a market, of roads, and wheel-carriages, this barony seems to have little temptation to increase its corn culture. The nearest grist mill that deserves the name, I had almost said the *only* one yet in Kerry, is at Killarney, 30 miles off. There are indeed two mills in Iveragh; they may be worth £. 10 each.

and is peculiarly adapted to this district.

It may appear strange, that I should propose irrigation as a remedy for those Bogs which appear to be at present useless only from their excessive wetness; but in so doing, I beg that I may not be misunderstood. The benefit of irrigation is necessarily connected with an effectual drainage; and from what I have already said, it may be seen, that I place my hopes of advantage in the rapid transmission of that water, which is at present injurious by its stagnation.

Is to be combined with drainage.

It must have appeared to every one who has visited such ground as that I now report on, that wherever there are roads or trackways along the sloping ground, and above the Bogs, there are considerable patches of good pasture below; these can frequently be traced as improvements on the Bog, consequent to the formation of the road. At all times we find that this is owing only to the overflow of that water which is collected by the road, as by a catchwater drain. It may be said that the improvement is owing only to the sand washed from the road over the Bog by the stream. Without entering into that enquiry, I will only state, that those natural hollows where the water is constantly soaking, continue little better than quagmire; while the banks between them that appear only wetted in flood-time, are quite firm, and afford good pasture, even although formed over a considerable depth of Bog. Here, then, we have a Bog naturally reclaiming after the formation of the catch-flooder, in the very same situation in which it had formerly accumulated.

Instances of its effects in reclaiming Bogs.

In some places of the country, the value of this improvement seems beginning to be understood.

I have met with a few, and but very few places, where the method of turning the water on the Bog has been attempted. The most perfect example is about two miles north of Killarney, where a common peasant, seeing perhaps the effect of such a washy hill stream upon the Bog below, has turned it over a few acres, by means of little channels of two or three inches deep; and has thereby not only procured abundant crops of hay, but has so far ameliorated the Bog, as to admit of bringing carriages over it, the tracks of car wheels being visible on it when I first saw it; while the neighbouring Bog, originally every way similar, continues one of the most dangerous swamps in the country.

I might here mention the valuable savannah formed in the eastern part of the District by that enlightened agriculturist, Mr. Allworth, of Newmarket, much of which is upon a Peat Bog. The value of irrigation is indeed beginning to be felt in the county of Cork, and the practice gradually extending into Kerry; chiefly, I believe, from the example of this gentleman. I need hardly mention here the numerous instances where this practice has been found useful in England; especially on the Duke of Bedford's estate at Prisley Bog, near Woburn. It is also common in Switzerland; doubtless in imitation of the very ancient irrigations of Lombardy.

It seems generally imagined, that the only benefit of irrigation is in refreshing the plants, and promoting vegetation, when they are suffering from the effects of long-continued droughts; and that therefore any attempt at irrigation in mountain country must necessarily be imperfect, since at that very time the water is wanted, these mountain streams are dry. However common this view of the subject may be in those southern countries, where the drought of summer constitutes the chief obstacle to the raising of live stock, the situation of things is very different in our isles. The great difficulty our grazier has to contend with is, the supply of winter, and especially of spring food, for those cattle he can graze in summer on the upland pastures. It is precisely on this account that irrigated meadows are so much valued in Wilts, Gloucester, and other parts of England, where they have been long well understood; and where they, from the scantiness of water and fall, are frequently formed at great expense. On the south borders of Scotland, a country very similar in conformation to this part of Ireland, they have also been found of the highest benefit; and in the uplands of Aberdeenshire, irrigation by catch-work has long been employed, as one of the simplest and most valuable means of improvement.

May be done by mountain streams,

In all these countries, it is well known that the time for the application of the water is chiefly during the winter, the latter part of autumn, or the early part of spring: the application during summer should be but transient, and managed with caution.

in winter.

It must have been observed, that the meadows which produce the most abundant crops of hay, are those which are naturally overflowed every winter. Instances of this I have seen in

A remarkable meadow.

(5.)
EXTRACTS
from the Appendixes to preceding Reports.

Rep. IV.
Mr. Nimmo.

in several parts of the Highlands of Scotland; but none more remarkable than towards the east-end of the great Moor of Rannoch, which is in fact an extensive upland Bog of nearly twenty miles by twelve. The waters of this Moor, in passing eastward, are obstructed by a ridge of rock, and immediately behind it expand into a small lake called Loch Eoch. The upper rivers at the head of this lake have formed an extensive meadow, which is overflowed every winter, and the greater part of spring; no cattle therefore can get to it in the earlier part of the year, and during summer, they are removed to the higher pastures in the mountains. The meadow being thus preserved, affords an abundant crop of hay, which is regularly cut and stacked during the dry months of summer at the side of the lake, though at a considerable distance from any habitation. This meadow is now divided among several sheep farmers; and the importance of it may be guessed from the circumstance of a hill farm connected with it, which on an old lease was rented at £. 90 per annum, being now let for 900 guineas. The value of this hay meadow suggested a project for cutting a new channel through the rock, and laying dry a little more of the lake; but on account of the excessive hardness of the rock it had, after proceeding a few yards, been abandoned, when I first saw it. I think it was fortunate that the difficulty of this undertaking prevented its execution; for although it would doubtless be an easy matter greatly to extend meadows of this kind, and especially that one, the method adopted here would have probably, at this high elevation (1,000 feet above the sea,) converted the meadow in a few years into a Peat Bog.

From what has been now stated, therefore, we may learn, that the good pasture ground on the banks of rivers in these Bogs, is not so much to be ascribed to the stream having cut down the Bog to the fertile subsoil, as to the deposit or other benefit produced by the periodical inundation. We are enabled to imitate this procedure of nature in the mountain country, by the general elevation of all the affluent streams; and even the lower recipient river, by a little expense, may have its benefit greatly extended.

Moderate rains deliver one cubic foot from 100 Irish acres;

From various experiments in the District, I find that in moderate rains, there is delivered one cubic foot per second, of water, from each hundred Irish acres. Winter floods give about three or four times this quantity; and summer drought may diminish it to one-third. The experiments were made in the District of the Laune; but I have found they agree well with the measures taken on the Eeny. It follows therefore, that we can at any time produce the effects of a winter flood, by laying on the water of three acres over one, in moderate rains, or of nine acres in drier seasons; perhaps a greater quantity may be necessary, if it be found that vegetation consumes more than one-half of the water supplied by rains; a circumstance highly probable in ground chiefly occupied by aquatic plants.

which may irrigate 18¼ acres.

If it were proposed that the water should flow over the whole surface, to the depth of a quarter of an inch, and with a velocity of three inches per second, a greater velocity would gutter the mossy soil; than in moderate rains, the water of 100 acres will spread over a breadth of nearly 200 feet; and if that water be caught, and re-applied during a descent of one Irish mile, as may generally be done throughout Iveragh, the ground thereby irrigated, will be 18¼ Irish acres, or nearly one-fifth of the supply. The Bog land of Iveragh amounts to about two-thirds of the whole surface; it is therefore possible to irrigate to the extent aforesaid, one-tenth of the whole of it at one time by mountain water. If to this, however, we add the quantity of upland and mountain, which may be similarly, and perhaps even more profitably watered, and the quantity which might be irrigated by the draining from the Bogs, the value of a system for bringing the streams into an economical management, will be sensibly felt; since, taking an average breadth of one mile and a half, from the summit of the mountain to the river, the quantity irrigated will be 41 acres 10 perches in every 300 acres of surface; of which 36½ acres are of Bog, and 4 acres 90 perches are of mountain.

If my ideas respecting the benefit that may be derived from any water be just, the quantity that may be improved may be conceived to lie in the form of a triangle, having its base at the river-bank, and vertex at the summit of the mountain; and as the base of this triangle will be upwards of one-fourth of that of the parallelogram, the lower part would appear to be much more rapidly reclaimed than the rest. It must be observed, however, that in all pastures irrigated by catch-work, the upper parts are better and more speedily ameliorated than those below; namely, the power of applying any part of the recipient river, which enables us, after all, to make the most effectual water-meads by the banks of the stream. The improvement, therefore, considered as progressive, may be supposed to begin from nothing, at the summit of the ground; to make rapid advances at the upper edge of the Bog waste; to be more slow in its operation below that, but most rapid of all, along the edge of the river. And if we look at the map of Iveragh, this is precisely the state of its cultivation; so that, in extending the benefit of irrigation, we are following exactly the procedure of nature, —the mode of irrigation proposed for the Bogs.

Draining is necessary,

In laying out any mode of irrigation, it must be distinctly understood that the waters are to be brought under absolute command, so that any part of the ground may be laid dry or wet, at pleasure.

ut not to a great depth.

Now the Bogs are at present sufficiently wet, and our operations should commence by removing this superabundance of water; in fine, any system of irrigation must be combined with an effectual drainage. In draining Peat Bog, however, it does not appear to me that any more extraordinary processes are requisite than in any other kind of ground. Wherever vegetation is expected, the water must be somewhere near the surface; and if this be requisite in every other soil, it certainly cannot be dispensed with in Bog, which, as is well known, when perfectly dry, is as barren as a piece of cork. Now if it be requisite to dam up the water in a Bog, after deep draining, for the uses of vegetation, perhaps the cheaper way would be, to leave it at that level at first. Besides, whatever my opinions might be as to the value of deep drains in some situations, I cannot accede to their being necessary in this District, where in a few yards, I have seen a difference of level of from 10 to 20 feet in the surface of a deep Bog. Could the water, which was abundant on the higher part, been easily transmitted through the interior part of the soils, surely such a head as this must have made it move. The upper part of the soil is the most porous and fibrous, and can offer little obstruction; and if the interior part be water-tight, we can have no advantage by deep cutting, but a fall to discharge the water from level drains. There are very few places in this district where this is necessary, the fall being almost every where obvious and great. And for this reason, after levelling over some of the Bogs, I thought it would be an unwarrantable mis-spending of time to carry on that operation to a great extent, which may account for the few sections with which this Report is accompanied. The chief application, therefore, that I have since made of the level, is to a purpose which will immediately appear, but in which it will be seen, that few sections are necessary. The water in these Bogs appears to pass chiefly over the surface, and, as usual in such cases, if we intercept and turn it away where it first appears, a great step will be made towards drying the ground below. The surface of the Bog consists, to a certain depth, of a thick intermatting of aquatic plants, through which the water can make its way but very slowly, even on rapid slopes; and below that, whether by the capillary attraction of the fibrous moss, or the actual adhesiveness of the compact Black Bog, the soil is almost impermeable to water. This circumstance is indeed so well known, that Peat Moss is frequently employed for the puddle walls of canals and other hydraulic works; a circumstance, by the way, which we may turn to account in our draining operations on the Bogs.

Catch-water drains first;

I commence, therefore, my draining operations by ascending to the upper edge of the Great Bog Field, where the subsoil is within, at most, three feet of the surface, and which is in many cases just at the foot of the arable land. There we lay out a level line, upon both sides, into the neighbouring stream, where a small weir is to be erected of rough stone, gravel, &c.; and, in a few instances, the unfavourable nature of the site has obliged us to sacrifice a little of the ground. This catch-water to be cut one foot into the firm subsoil, in all, four feet deep on an average; five feet wide at top, and two feet at bottom.

It will be proper to take off one yard in breadth of the sod on the lower side of this drain, and in throwing up the stuff on that side to form the level bank, to dig and incorporate it with the subsoil below; the remainder of the excavated stuff to be thrown in heaps, to be afterwards burnt, and applied as a top-dressing to the Bog.

Though the above Bog drain may be trusted to in most cases, yet a more perfect puddle on the lower side would not be unadvisable. For this purpose, dig out the drain four feet wide at bottom, then placing one row of sods within a foot of the lower side, fill up behind it with clay and bog-stuff, to be well wrought with the spade, and trampled down (it will generally have water enough); after this, another row of sods and backing, till two feet deep; the remainder to be done next day. With such a lining as this, the water may be made to run with any reasonable velocity, without endangering the sides of the ditch; and the whole forms a good head-fence for the ground to be improved.

I have said, the upper part of this catch-water is formed level with the surface; it will, however, be proper that the bottom be drawn with a declivity of one inch to the hundred feet from the stream, on either side, to the middle.

As there will be some danger that winter floods may injure the small weirs in the streams, it will be proper, at much higher levels, to make small channels of diversion from the stream, down the hill on either side; this will have the double advantage of producing a deposit of mountain gravel and sand on the rough pasture and bog of the hill, and weakening the effort on any given part of the catch-water. These channels may be drawn with a quick slope, so that the water may run briskly along in them; and even should the hill-side be cut thereby, there will be no material injury, as it may be again diverted.

may be employed as a flooder.

More advisable to have a separate flooder.

If this first catch-water is to be employed at any time as a flooder, the upper edge of its bank must be carefully trimmed to the level; but I believe, on the whole, it will be more advisable to make a separate flooder immediately below, which may be cut at the exact level by means of the plumb rule, to the depth of one, and width of two feet, with an outlet from the catch-water at every five or ten Irish chains.

Other flooders,

Parallel to this first flooder, there should be another at two or three chains distant; but this, although its bank, at every ten Irish chains long, is to be formed on the level of the turf, yet its bottom must be one foot deeper down the stream than above, that it may act on occasion as a tail-drain. In like manner, the next flooder below on the same line should have its bottom a prolongation of the slope of the bottom of the other; but its level bank will be a foot lower, and so on lowering successively one foot every ten chains. The intention of this is, not only that each flooder may act occasionally as a tail-drain, and run freely at such times without soaking through its bank, but that the whole water of one catch may be occasionally turned on the lowermost piece, with the least possible loss of fall.

act also as tail-drains.

My reason for sloping each of these down the stream, rather than upwards, or from the middle of the catch to a cross drain at each end, is, that up the valley the supply of water is most abundant, the mountain becoming ultimately a great basin; and by turning the water down, we are the longer getting to the recipient, and of course our supply of water is the more useful.

Cross-drains.

Across these flooders, and directly down the slope, a drain must be formed at every ten chains distant; the depth of this need not exceed one foot, for indeed it will probably cut deeper in time; but it will be proper, for various reasons, to lay a sill in it where it crosses the catch; for which purpose, the common slate and flag of the country will answer extremely well; one being buried on edge, with the upper side a little above the bottom of the catch, and another laid flat below, that the bottom may not be too much injured by the over-fall.

As the catches drain only one way, a sod or a slate, which may be used for a stop, will determine whether the water shall stop and flow over the upper catch, shall run along the catches, or shall turn down the cross drain.

Springs, where found, easily obviated.

Lower catch-water drains.

Having thus disposed of the whole slope into a series of catches and cross drains, I believe it will be readily admitted, that the surface of the Bog may now be laid under water at pleasure, and may be likewise laid perfectly dry. It is evident that surface water, wherever it appears, will be quickly disposed of by means of the catch-water delivering it into the cross drain; were there ever so great a spring, therefore, to appear in the Bog, its injurious effects must be confined to a part only of one of these patches or fields, which at most contain but two or three acres. But it is obvious, that if a spring of this kind be any way troublesome, the farmer will adopt the expedient of cutting a short cross drain to deliver into the nearest catch, which cannot be above thirty or forty yards off. If he finds that there is a stratum rising to the surface which delivers water along a considerable level, his remedy will be a level drain, which should be made hollow, so as not to cut up his ground, and a cross drain as before. But the chance of springs, &c. will be greatly diminished, if not entirely done away, by the adoption of the above expedient. For, independent of the speedy removal of surface water, which by sinking and repearing, is the most frequent cause of springs, and of which there are many curious instances in the Bogs, the catch-water drain at top, which descends into the firm subsoil, or at least into the silty earth, as it is termed by the workmen, will effectually remove any underground supply, and of itself will be a great step towards the drainage. For which reason, and because the peculiar situation of these Bogs, and the position of the strata below, makes a succession of benches, it were on the back of which we have deep Bog gradually rising up the slope above; but which upon the edge, and a little below, is comparatively thin: as there can be little doubt but each of these successive benches of Bog owes its origin to the supply of upper water, it may be expedient, besides the main catch-water aforesaid, to make several more between that and the river. I certainly do expect, that the first one will in a great measure, if carefully performed, remedy the chief part of the evil; but as its execution must frequently be entrusted to persons of inferior skill, and is therefore likely to be imperfect, I should have the less difficulty in proposing a succession of them.

Objection answered.

And here I cannot help taking notice of an opinion, which seems very common in this country, where, in fact, draining is very little understood.

Discovery of the fall is but a small step towards draining.

Position of the catch-waters,

We are told, there can be no difficulty in draining these Bogs, as the fall is generally so obvious, and we have only to draw the water down the hill; now if this be the case, how comes it that these Bogs have been so long left in their present condition; or rather, how were they ever to become Bogs at all? The truth is, we have not advanced one whit in the business of draining, by knowing where the fall is; it is almost every where sufficiently obvious. I have not yet seen in Ireland a Bog where the fall was not as evident upon examination, as if it had been on the side of a hill; for I have seen, as yet, none upon which there was not some water flowing; so that the direction at least, if not the amount of the fall, was readily discovered. Ditches drawn down the hill are common enough in Ireland, where indeed there is perhaps every where a great deal of useless spade labour; but, as might be expected in a retentive soil, they drain nothing. They have not the least tendency to draw the water from the side, since they cannot possibly give more fall, either on the surface or below it, than what exists already in the ground. Side catch-waters are therefore absolutely necessary to prevent the infinite multiplication of these drains, by collecting the water of a considerable surface: in the position of these lies the great skill of the drainer. We frequently see numerous ditches drawn to join the main drain at every oblique angle, and running rapidly down the slope, as if the only difficulty were to deliver the water as quickly as possible into the main trunk. By these means, the field is entirely cut up; or if the drains are, with a view to agriculture, made hollow, the rapid slope enables the water to gutter their sides, and the stuff carried into them by that or other means choak and blow them up, so that they are in a short time rendered useless. The cross drains, or catches, must be therefore made as near the level as possible; the bottom may have a small inclination to favour the transmission of the water. A slope of one in eight hundred allows water to pass nearly at the rate of two feet per second, which is a greater velocity than is common in most rivers, and fully as great as the stuff in which drains are usually constructed is able to bear.

The situation of the cross-drain must next be attended to, that its effect may be the greatest possible; and in fixing this, we are assisted by the remark I have already made on the transverse section of the hill.

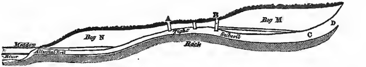
Thus, in the figure annexed, the cross-drain at A, although it may be very effectual in intercepting the water which would otherwise flow over the bank into the lower bog N, is not otherwise useful to the upper bog at M, since the intervening shallow, being left at its original level, there is the same cause as ever for the accumulation of the bog M. A drain cut at the shallowest place would be the cheapest catch-water; but one formed at B, (where the bog is, say four feet deep), and carried into the firm soil below, will not only be a catch-water for N, but will also be a very useful tail-drain for M. It must, however, be observed, that B, when formed, must have a low outlet cut through the bank towards A, at the level of its bottom. I conceive the flat or shallow basin between B and C to have formed a favourable receptacle for aquatic plants; and these, by decaying in that situation, have preserved a constant shallow basin for the land-water on the side next D; and that in this way the bog has gradually crept up the slope of the hill. If the piece of bog between B and A be extensive and pretty deep, say three feet deep, then we must suppose it a continuation of the lower bog at N, which in this way has extended over many original inequalities.

may also be useful as tail-drains.

Supposed origin of such Bogs.

Upon boring at side of several streams, where deep bog approaches the water edge, I find the subsoil immediately at the bank, to be for the most part as high, if not a little higher than what is immediately behind. This was indeed to be expected, as all streams which do not cut in their bed, and indeed, most of those which do, have their banks gradually rising by the depositions in flood times; and this deposition, which takes place only when the waters begin to overflow, must be evidently greatest, just at the bank where it first and most frequently occurs; it is also an additional proof, that the goodness of our pasture meadow, near the streams, is the effect of deposition, and not the wear or removal of the bog stuff. This property of rivers is so well known, that I think we need look little farther for the original causes which have produced these accumulations of turf in the vallies of this district.

Section :



It may be said, that the method I have now proposed for the reclamation of bog, will produce a very poor water meadow, since the catch-work drains being at such distance, will hardly have the effect of spreading the water over the surface; but it must be observed, that much of this is necessarily left to the waterman: small gutters must be cut, wherever the water appears likely to run into channels, with a view to cast it over the surface. To make a perfect water meadow of every part would require an expense, which, however likely to give an ample return, I do not expect to see laid out on those bogs, in the first instance; but the improvement here proposed, while it will unquestionably ameliorate and extend the pasture, and will thereby allow of much of the upland to be converted to tillage, may be executed at an expense not exceeding one guinea per Irish acre. It is therefore, in my opinion, well worthy of attention.

Although perfect meadows are not formed, the improvement is considerable.

But it will, in the next place be asked, are no methods proposed for the conversion of this waste ground into arable land? That peat bog is capable of such an improvement, if I had not already been satisfied of, by what has been done in this way in the lowlands, highlands, and isles of Scotland, I might have discovered by the slightest inspection of the district I now report on: there is not an atom of limestone yet found in the whole barony of Iveragh; neither do I think, from the geological aspect of the country, that any limestone or even marl, is ever to be expected; yet there is a great deal of the bog, in all parts of it, which has been so far improved, as to bear not only considerable returns of potatoes and other green crops, but even of wheat and oats. To green crops, as is well known, bog is particularly adapted. One of the most abundant returns which I have seen any where, was on a small croft on the road between Eeny and Curmne, where, after raising a heavy crop of cabbages in the earlier part of the season, the possessor had laid it down with grass seeds, sprinkling on a little shell sand; and when I saw it, the quantity of hay was at least worth, in that district, £. 6 per English acre, besides the after-grass.

The Bog is often reclaimed by tillage.

Flax is also raised with success in these crofts, but the quantity laid down under such crops usually so small, that no accurate statement of the return can be given.

The great, I had almost said the only object of cultivation, is the potatoe crop; and the process employed is almost every the same. The bog is laid off into a field of about two acres, and surrounded into beds about four or five feet wide, and intervening trenches cut: the turf is applied to increase the height of the bed; potatoes are then planted with shell sand, and all the manure the possessor has; the process otherwise is similar to the usual system in Ireland; the second earthing year of cultivation, the potatoe crop is usually better than the first; after which it is common to take crops of oats or wheat without manure: three or four of these crops, having been attempted, the last perhaps so little worth, or so liable to be blighted, that the improved bog is left to acquire a covering of such grasses as nature may provide-

Potatoes chiefly raised;

then oats.

Left for grass.

Often neglected.

provide. In this stage the drains or trenches are allowed to choak; and in two or three seasons more, the improvement is almost entirely effaced; the croft is sometimes a little greener, but in many cases is scarcely distinguishable from the neighbouring bog.

Causes of the neglect.

Operation of tythes;

One of the causes of this frequent neglect of the bog, after it is reclaimed, is, I believe, the peculiar operation of what is called the Barren Land Act; which, by exempting all reclaimed bogs for seven years from payment of tythe, acts doubtless as a bounty for their first cultivation. But in the usual rotations of cropping above-mentioned, which by the way is almost the constant routine throughout Kerry, by the time that the land is to be broken up from pasture to lay it down again in potatoes, with manure, the exemption from tythe has ceased, and the deduction from the crop in that way, which may be stated at one or two pounds per acre, is a discouragement to the continuation of the improvement. The great object with the small tenant is an immediate return; this he obtains by the potatoe crop. He cannot afford to lay out the labour of one year, even although it should be amply repaid during the next; he is therefore led rather to take the potatoe crop off a piece of new bog, when in his power, than one previously in cultivation, since there is the same expense of labour and manure, while a few years more places the former cultivated spot in the same predicament as before. This obstacle to the continued improvement of bog would be at once removed, were the allotment of part of the waste land to be substituted as an equivalent for ever for the tythes of the remainder. There could be no doubt but that this portion of the church-land would be as well rented as any other; and the exertions of the cultivator, unfettered by a tax upon his profits, would then be more likely to produce a rapid amelioration of the whole.

I should conceive many other benefits likely to arise from such an allotment. It is well known that the tythe is the great bar in England to the extension and improvement of arable land; since it must be a very advantageous speculation that will at once bear a deduction of ten per cent. from the returns. But in Scotland, where the revenue of the church is raised in a different way, this obstacle is not felt; accordingly, the most extensive speculations have been entered into for the improvement of waste land, although the want of capital is at least as great as in Ireland. This however is a subject which has often been discussed by abler hands; and with the various bearings of which I cannot pretend to be sufficiently acquainted.

and cultivation by beds.

But another physical reason for the temporary return that is expected from bog improvement is, in my opinion, the perseverance in the mode of cultivation by lazy beds. This is doubtless one of the best possible modes of procuring a crop from a piece of new ground; because the numerous trenches act effectually as drains, while the open heathy bottom on the bed delivers off the original superfluous surface water. But by digging frequently, and throwing on loose stuff, the top of the bog is rendered so open, and so much exposed to the sun and air, as at length to enable to retain water for a moment; while the deep trenches, so near each other, keep the interior moisture at too low a level for vegetation. It is a common complaint here, that crops on the bog are liable in some years to a total failure; and therefore no improvement can be ventured but by a tenant who is ensured against want, by having possession at the same time of a piece of dry arable upland. It is not unusual, in the improved bogs of Ayrshire, for the crops to fail on the top of high raised ridges. This is particularly the case with the corn, and even sometimes with the grasses. Those plants, such as beans, turnips, cabbages, &c. which strike their roots deeper, or overshadow the ground, are not so liable to injury. The remedy is evidently to lower down the beds into pretty level and broad ridges; not to crop too long before laying down in pasture; to cover the bog with earth, gravel, or other heavy soil, irrigation and rolling.

Conversion of the Bog into Tillage:

In improving the Bog, capitalists only could employ.

Canals,

and Railways.

In giving my opinion respecting the most advisable mode of converting these Bogs into arable land, I beg leave to premise, that the methods will be essentially different, according as the improvement is to be effected by the present occupiers, or by individuals, or companies possessed of extensive capital. In the latter case, means may be used for the economy of labour, the acquisition of manures, and the like, which in the former are altogether out of the question. Canals, for example, are of this description. The construction of a navigable canal, especially if provided with locks, involves with it such a host of extra expenses, very little connected with drainage, that I have no hesitation in considering it an useless and premature expenditure of capital in such a country. Nevertheless, I have ventured, in compliance with the fifth article of instructions, to suggest the propriety of converting one irrigating drain into a navigable communication. I have also ventured, even with this in view, to deviate from the dimensions prescribed in the sixth article: my reasons for so doing are, that the general relief of the ground absolutely prevents the possibility of a communication between any canal that may be formed there and navigations in other districts; and upon such a short piece of navigation as we can never look to any employment for large vessels, I have thought it better to suit the dimensions to the small boats of the country. The formation of railways, although better adapted to the configuration of this district, is liable to the same objections as canals. The slightest railway that could be of any service, would cost at least £. 500 per mile; and in such a country, where even wheel carriages of the rudest kind have hardly penetrated, it is not to be expected that the people could be easily familiarized with the benefits and management of a railroad. With navigations the case is somewhat different; the people are in general good boatmen, and so well acquainted with water-carriage, that even the short navigable reach of the Eeny month is taken advantage of by those who have occasion to carry shell-sand to farms above; and upon the river Valeutia the transport of the shell-sand of Begnish has the appearance of a lively trade. I may observe by the way, that in making railroads, iron is much to be preferred to wood: it is, on the whole, nearly as cheap, more durable, and, as now made, by locking together, is much less exposed to depredation.

But much of the Bog is reclaimed by the present tenants.

That the Bog may be reclaimed by the present occupier, the first step to be taken is its drainage. I have already declared my opinion respecting deep drains.

First by catch-water drains.

The catch-water drain is to be first formed on the edge of what in Scotland is called the bent moss, or on the boundary between the Bog and "montaan;" the most advisable situation is that which I have marked. This will answer at the same time as a head fence.

Paths on some ridges.

The Bog is next to be marked off into ridges, at distances of one perch asunder, and a small furrow taken out with the spade, one foot wide and ten inches deep. The spade used for this should be a foot wide with a small feather; which will save time in casting. If the Bog be pretty flat, the whole declivity will be wanted in the furrow, which must therefore be drawn in the direction of the fall, and a small water furrow of moderate depth drawn here and there obliquely across the ridge; if otherwise, the original furrows may be made obliquely down the declivity, and will of themselves act as water furrows. The Bog must now be left some time, to get relieved of the surface water. In the next place, let a small path be formed by carrying gravel and earth out on the middle of every third ridge, so that two ridges may be left in the original state between every two other ridges which have a path in them. The width of the path may be three feet at first, and at least six inches deep of stuff; it being previously observed, that the turf from the furrow on each side is cast into the middle of that ridge. The most convenient way of forming this road will be by the wheelbarrow and planks; if that is not to be had, a hand barrow must be employed. This path is intended for horses with panniers, by which it might be extended afterwards to six feet wide; and at least it may be proper to make some turning places on it of that width.

Bog to be levelled.

Top dressing of sand,

grass seeds,

In the next place, let the Bog be dug up, and carefully formed into ridges, which must not be too high, so as to render the middle liable to injury by drought. The higher parts of the Bog must be levelled down into the hollows; but if there be any turf holes or other deep gashes, it will be proper to slope the sides down gradually, it being found by experience when such holes are filled up with loose Bog stuff, that its porosity prevents the supply of water necessary for vegetation. The surface of the ridge must be carefully pulverized with the spade, hoe or otherwise; and as it gets dry, the ridges which have the path in the middle may be harrowed by horses, by the help of a splinter bar somewhat longer than common; a top dressing of shell sand being now applied, which may be carried on the Bog by means of horses and panniers. It would be advisable to leave the Bog for one year, to consolidate in the interior, and pulverize on the surface; that part which is intended for pasture being sown with grass seeds.

or oats.

Potatoes more likely to repay cultivation.

Course of crops.

But the tenant will naturally look for some crop, the very first year after performing this labour. In that case the dressing of shell sand or other calcareous matter being applied, the ground may be sown with oats, and a tolerable crop may be relied on: but potatoes are more likely, in this country, to repay the cultivation; a crop therefore of these may be taken in the usual way, that is, by forming beds across the intended ridges (the permanent formation of which may be deferred until the next season,) and with stuff taken from the trenches, earthing over the plants. Manure however, in this case, is absolutely necessary, and if not to be got in sufficient quantity, earth should be carried out on the Bog wherever it can be had. The manure may be greatly increased in quantity by intermixture a few weeks before hand with the turf or other vegetable matter. Next year the lazy beds may be formed into ridges by filling up the intermediate trenches, a top dressing of sand applied, the Bog sown with oats or wheat, and harrowed in by horses when practicable, or by men.

The third year of cropping may be oats or barley, with perennial grass seeds, which being cut for hay next year, will leave the ground in a tolerable meadow.

Another Rotation proposed:

Another course.

1st year, potatoes with dung in lazy beds, applying gravel and clay. 2nd. Oats in ridges; more gravel and clay; the turf next burned along with clay. 3d. Cabbages and flax. 4th. Potatoes with dung. 5th. Ploughed for oats or wheat. 6th. Barley with grass seeds. 7th. Hay. 8th, 9th. Meadow.

Turnip husbandry is unknown in this quarter, I have not therefore expected that it will be introduced by the tenantry; rape is little known; there are no oil mills; and it could only be eaten off by sheep; and thus, producing no immediate return, I have not included it in the system.

In the following estimate I have been partly regulated by a reduction of the prices for which the same things are done in Scotland on similar soils; and aware of the great changes to which the wages of labour are subject, I have stated them by day's work, as nearly as could be ascertained, from a comparison with the system employed in the country.

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The labour must necessarily be done at first with the spade, but the supply of water being cut off the Bog by evaporation, and the consumption of vegetables, sinks and consolidates so far as to bear ploughs, horses and carts, after a few years cultivation. In great droughts water may be brought down the middle of each ridge from the catch-water at the head.

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Estimate for First or Potatoe Crop.

Estimate of first

	Labour in Days.		—		
	Men.	Horses.	Expenses.		
			£.	s.	d.
Formation of a head catch-drain of two perches; it may be done by one man in eight days with ease; the wages are 10*d.* per day	8	- -	—	7	6
Cutting out furrows, and levelling ridges, 160 running perch	10	- -	—	8	4
A footway on every third ridge, 1 yard wide, in all 60 running perches, including crossings, to be done with horse and pannier, or wheelbarrows in preference	20	20	1	13	4
A top-dressing of 60 loads of shell-sand, &c.	20	20	1	13	4
Formation of lazy beds, dunging and planting potatoes	40	- -	1	13	4
Second earthing, taking up and carrying off, in all	50	8	2	8	4
The dung is worth 1*l.* 10*s.*	- -	- -	1	10	—
	148	48	9	14	2
The return 120 pecks, deducting 16 pecks of seed, is 104 pecks of 10 stone each, or 52 statute barrels at 2/ per peck	- -	- -	10	8	—

Therefore from this result of - - £.10 8
deducting the value of the manure - 1 10

196 days labour give a return of - £.8 18; and consequently give the wages of 10⅔*d.* per day to the labourer.

The present wages are 10*d.* per day; and the price of potatoes, which we take at 2/ per peck, is more commonly 2/6.

Estimate for the Second or Oat Crop.

and second crop.

	Labour in Days.		—		
	Men.	Horses.	Expenses.		
Reducing the lazy beds to regular ridges	24	- -	£. 1	—	—
Giving a top-dressing of sand and earth	21	21	1	15	—
Harrowing	6	- -	—	5	—
Reaping 6, making ricks 2	8	- -	—	6	8
Carrying off and stacking	1	1	—	1	8
Threshing 5, dressing 1	6	- -	—	5	—
Carrying to market	2	4	—	5	—
Total time employed	68	26			
Say 94 days in all, at 10*d.* would be only	- -	- -	3	18	4

The produce, deducting seed, is 12 barrels, statute measure, at 14/ present price 17/	£.8	8	—
Straw worth	1	—	—
Total	£.9	8	

Total - - £.9 8; which is 2/ per man or horse per day.

It may be thought improper to state the hire per day of a horse the same as that of a man; but in this pasture country, horses are numerous, and their labour little valued.

They will repay the labour,

It appears, therefore, from the above Estimate, that the cultivation of Bog may be undertaken by the occupying tenant in the country. During the operations for his potatoe crop, we may state his wages as from 8¾*d.* to 1*s.* per day, according to the goodness of his crop, and the price, valuing the potatoes at 4*s.* per statute barrel. The general wages of labour in the country are at present 10*d.* per day. But his labour on the second or oat crop will produce him at the rate of 2*s.* per day, while we value the labour of the horse per day, in each case, at the same rate as that of the man. Now it may also be observed, that the time occupied by the labour of the man is, at potatoe crop, 148 days, and 48 days of a horse; at the oat crop 68 days, and 26 days of a horse; so that it is perfectly competent for one man and horse to labour two acres at least in this stage of the business; viz. one acre of ground, to be brought in from Bog by potatoes, and another under a second year's crop of oats. The horse being comparatively so little employed, we may take his labour as being applicable at least to the cultivation of five acres; in which event, adding another man, we should have for the support of two labourers with one horse, the produce of 2½ acres, or 130 statute barrels of potatoes; 2½ acres, or 30 barrels of oats.

and afford rent and tythe.

For the next year, the process of paring and burning will, as is well known, produce an abundant crop of cabbages, &c.; but the price cannot be easily stated. But it is evident, that the value of the land will increase, while the necessary labour of cultivation will diminish. Taking, however, the revenue from the land at only one-fifth of the above clear produce, as equal to tythe and rent, we have for that purpose, for two men occupying five acres,

	£.	
½ acre potatoes, at least 26 barrels, at 4*s.* - - -	5	4
½ acre oats, 6 barrels, at 14*s.* and straw, 10*s.* - -	4	14
	£.9	18; which is 1*l.* 19*s.* 7⅕ *d.*

per acre for tythe and rent, after two years cultivation only.

Subsequent returns greater, though not easily valued.

It would be difficult, as is already observed, to value subsequent crops while under the management of the small tenant; but it may be seen, that even with several successive crops of oats, which, as is well known in Scotland, may be taken off moss upon the application of a little manure, the return to him must be at least two shillings per day, in a country where wages are at present only 10*d.*

The potatoe crop in that country would be much more productive per acre; but as it also takes much more labour than the other, even independent of manuring and top-dressing, it will not give a greater return for the number of days employed; so that, although very likely to be more followed in this case than the oat system, or that of a regular rotation, it is better fitted for situations where land is scarce and labour plenty. On the Bogs we have an abundance of spare land, and the quantum of labour which can at first be directed to them is likely to be but small. But from what is already stated, it can surely be considered as no very sanguine expectation, to look forward, in a few years prudent cultivation, to the Bog being valued as high as the neighbouring land in arration, which now rents at three guineas and upwards per Irish acre.

Another mode of cultivation.

There is another mode of cultivation, which is also within the reach of many of the present tenants. It may be particularly useful when the necessary manures are too distant, or difficult to be procured, as is particularly the case towards the higher parts of Eeny-Fahrta, and Glen Carra.

The Bog is simply trenched over with the spade to the depth of eighteen inches or two feet, taking care to shovel out the bottom of the trench quite smooth and clean; the sods are turned with the heath side down, and the black Bog, which is turned to the surface, is well pulverized with a spade, &c. There are also cut in the solid Bog small trenches or gutters, running obliquely down the slope, and collecting in a furrow or surface open drain. The heathy turf which covers these small gutters prevents them from filling, and the whole process produces a very general underdraining; the Bog, in a short time, becomes covered with chick-weed, and soon after produces a tolerable meadow. This method was first suggested by Anderson, and has been successfully carried into effect in some parts of the south of Scotland.

Deep Bog not likely to be ventured on,

The methods above explained, of converting the Bog into arable land, may be successfully practised upon all those parts where the fall is so considerable as to require no extraordinary operations for the removal of surface water, or where the subsoil for top-dressing, and shell-sand or other manure, is within a reasonable distance of the spot to be improved. But perhaps we must not look to such means for the improvement of the deep red Bog and flows, at least for a long time, if even the tenant is likely ever to venture on such an undertaking. But if this business is to be undertaken by individuals or companies of spirit and capital, there is surely little difficulty in reducing any of them to a productive condition. I am almost afraid to state my opinion of the benefit to be derived from this undertaking, lest I should be thought too sanguine in my expectations; I trust, however, that it will be seen, that the results I calculate upon are founded upon just grounds, and not at all over-rated.

but by Capitalists;

who should irrigate.

The first object of amelioration on a great scale, seeing that manure is at present to be had in very limited quantity, is the improvement of the pasture by irrigation. This, by increasing the amount of live stock, readily procured, and comparatively easily supported, will increase the quantity of manure, and thus re-act on the Bog again, or conjoin with it the extention of the arable upland. I have already stated the way in which this should be done. I proceed to give

An Estimate of the Expense, per Acre, of Irrigation.

Expense of irrigation, per acre.

The Bog is so laid out, that the greater catch-waters or drains occur at not less than ten chains down the hill from each other; so that we may suppose it divided into squares of ten Irish acres each.

	£.	s.	d.
Then each acre has one chain of main catch-water, 5 feet top, 2 feet bottom, 4 feet deep, costs 1*s.* 10*d.* per perch - - - - - -	—	7	4
Five flooding drains, 2 feet by 1; 20 perches; 31 yards at 1½ *d.* - -	—	3	10½
Cross or main drain, same dimensions, 4 perches - - - - -	—	—	9½
Proportional expense for weirs, &c. - - - - - - -	—	1	—
The wages of a waterman, one to every 200 acres, say 20*l.* is - - -	—	2	—
	—	15	—

This supposes the flooding done by hends in the flooders, or small dikes of the Bog, left with a triangular sod cut out in the middle of each.

Expense when farther improved.

But that the works may be more complete, led us add a flag or brick culvert over the tail of each carrier as a road, a stone frame at the cross-drain, and a slate for shutting the drain, and diverting the waters.

	£.	s.	d.
The culvert of hollow drain, 4 yards at 2 *d.* made in Britain for 1 *d.* - -	—	—	8
The frame at the cross drain of flag, or 5 bricks - - - - -	—	—	4
Slate for shutting ditto - - - - - - - -	—	—	3
	—	16	3
Add for unforeseen expenses, at 20 per cent. - - - - - -	—	3	3
And for superintendence in execution, 10 per cent - - - - -	—	1	11
Total expense per acre - - -	£. 1	1	5

Effects of the first.

The water should be allowed to flow along the carriers every flood, for some time before the cross drains, culverts, and puddles are made. This will produce a material improvement of the soil, and render at least the turf immediately for the carriers more fit for the purposes of the works.

If thought proper, the cross drains may be doubled; viz. one at every five chains. The excavation of these may be saved in making the carriers smaller and shallower; but the number of culverts and puddles may be doubled, which will add 1 *s.* 3 *d.* per acre to the expense.

The deposition useful.

But in my opinion the improvement of the soil is independent of the formation of the cross drains and culverts, which are, in fact, only necessary for the perfect formation of the water meadow for crops of hay. It is unquestionable, that there will be a considerable deposition of the soil on the Bog, by means of the flooders. This deposition, indeed, will in time fill up the flooder, and may be therefore thought to injure the works. But this is evidently a desirable event; for instead of clearing the flooder, there should be a new one opened immediately above the former, and so on continually. The ultimate effect of this will be, that we convert, or rather cover the whole surface of the Bog with a layer of the finest soil, at the expense only of digging it ten inches deep. This result is infallible, although it is perhaps a work of time. Let us enquire into the probable period. It has been calculated, that rivers carry into the sea the one-four hundredth part of their volume of earthy matter. Mountain streams and floods certainly take a great deal more. But at this estimate, the water which flows three inches per second, and a quarter of an inch deep, over a line of 192 feet, will in 400 seconds deposit a quarter of an inch of soil on 192 feet in length, and three inches wide. In 1,600 seconds, the width will be one foot, which produces a covering of soil one inch deep over an Irish acre, in 27½ days, or say, in one month.

This quantity I have already shown to be produced from 100 Irish acres, so that if we catch the waters of 100 acres of the uplands and throw it on twelve acres of Bogs, we have a deposition of one inch deep on the surface per annum. I know of no method of transport by which this result could be produced, at less expense than £. 60 per annum. But this is only one instance of the many advantages procured by a skilful irrigation, an operation too little attended to, although it is often observed, that no mode of improvement can be more profitable or less expensive.

Herbage also improved.

The benefits of this system are not confined to the amelioration of the soil; the water will speedily destroy the heath, and substitute for it the more useful grasses, and although the weightier cattle may not be entrusted on the watered ground for the first year, the crop admits of being easily preserved for hay. Having this return in view, a greater expense may be laid out, on a part at least of the land to be watered, so as to make a perfect meadow. Pare off the upper sod of turf, and smooth and level the subsoil; lay down the upper turf again, and allow it to dry, before the application of the water in the months of March or April. The return of hay, which may be relied on the latter part of summer, will be three tons at least per Irish acre, which in this country, at £. 2 per ton, will be amply sufficient to repay the whole of the expense; besides leaving the ground in a permanent and progressive state of improvement, which may be said to cost nothing whatever.

Hay, worth £. 6 per acre.

The principle employed in many instances,

Being anxious that the effect of these operations should be perfectly understood, I beg leave to remind the Board, that lakes and marshes are frequently laid dry, by turning in the troubled water of a river, until the deposition raises the bottom above the usual surface-water; after which the river is either turned off, or a bed left for it in the alluvion. This has been practised to a great extent in Languedoc, Lombardy, and other places, and in our own country the same principle has been applied to raise the low flats on the Severn, Dee, Humber, Forth, &c. with the greatest success. If, in such cases as these, where there is naturally a water-carriage to every spot of the land, this method be found more advisable than any other, surely there can be no hesitation in recommending it for the improvement of Bog, where the softness of the soil is a continual obstruction to the formation of roads, railways, canals, or modes of transport of every description.

In a lake or deep morass, the quantity to be filled in at one place is considerable, and might be well worth the expense of a railway at least, which can be transported to a new situation with comparative ease. The depositions from a river are gradual, and although general, it will be long ere they have any perceptible effect. In the Bogs, on the other hand,

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hand, the very first deposition will produce a visible benefit, and every succeeding one extends it.

In a lake the affluent river will deposit its sediment, because the waters are deprived of that velocity which enable them to move those materials before. In fact, every river begins to deposit when its rapidity is diminished, and begins to cut up the bed whenever its velocity is increased.

We imitate this process on the Bogs, by laying out dykes and drains on the horizontal line, and thereby when the waters are turned in, form long and narrow lakes on the sloping, and broader on the flat Bogs. It would be useless to make these dykes and drains large; it will be far better to make a succession of them; for we will thereby be enabled to produce a considerable deposit on one tract, while others above and below afford us an useful pasture. There are, however, cases where a short dike at a gullet, converting an extensive piece of Bog at once into a lake, may, by the help of a river near it, produce a considerable improvement.

Observe, that this system does the least possible damage to private property. We want nothing but the sediment. When a river therefore rises in flood, its superabundant waters being caught high, and spread out over these extensive lakes, may return purified, as the flood abates, even by the same channel as that they entered; so that the meadows below are preserved from floods and depositions, which they now have no need of, and the mills are supplied with water which would otherwise be wasted.

and may be otherwise of benefit.

But after we have transported the water at high levels to a great distance from the channel, it will be greatly more advisable to deliver it with this advantage of fall to irrigate the grounds, and supply the machinery below. The carriers therefore, which are formed in this manner, will be works of the greatest utility, even after they have ceased to be necessary for the improvement of the Bog.

Capitalist will look to an extended agriculture.

Besides the improvement now proposed by irrigation, and "warping," the great capitalist will naturally look to an extended agriculture. It is not, I presume, expected that the engineer can communicate much agricultural information to persons likely to embark in an adventure of that kind. And indeed I have little to add to what I have already proposed for the smaller tenant*. What I have recommended for him to be done by horses and panniers, according to the present system of the country, will naturally be done by the other, by means of wheel carriages; I should therefore recommend a path down the middle of every second ridge; and in a few seasons, especially if the ground has been previously warped by irrigation, the lands may be ploughed by horses, and the crop removed by carts. This will lessen the expense of cultivation nearly one-half, and give a consequent increase of profit. That this advantage may be more early procured, I have thought of an addition to the present car, which will enable it to be taken over soft Bog or deep roads, and will render it also of great service in the general system as a roller. I have described this new implement in an Appendix.

Railways.

Railways have been employed for the purpose of spreading gravel and earth over a bog; and first, I believe, in Lancashire, by Messrs. Roscoe and Wilkinson. If it be thought advisable to adopt such a system of transport, I should recommend that they be made of iron, and that the wheels should run on the top of the ledge. I have contrived that the car above-mentioned may be used on such railways, and at the same time fitted for travelling on common roads.

Roads more immediately necessary.

Roads must be made in any country which is advancing in agricultural improvement; and it is fortunate that we are enabled in the bogs to adopt the best possible lines, without being obstructed by inclosed property, or great inequalities. Having once these, the formation of canals and railways may be an after-thought; for they are rather fitted for a state of cultivation in which capital and produce are abundant.

Value of Wheel-carriages exemplified.

That the introduction of wheel-carriages is a much greater step in cultivation than any subsequent improvement of them, will particularly appear from the following estimate of the loss sustained in this district on that account alone.

The quantity of butter sold in Cork last year, was 250,000 firkins; of which, I suppose, one-tenth came from Iveragh, or at least from that barony and Dunkerrin, viz. 25,000 firkins.

This must have been carried in horse loads of two and three firkins; say two and a half on an average, with each horse and driver, makes 10,000 journies of horse and driver per annum.

Now suppose good roads to be made, and carts substituted; these carts might carry 20 cwt.; but we shall suppose them loaded only with 18 firkins, which at present require $7\frac{1}{2}$ horses and drivers, say only 7; then each cart saves the labour of 6 horses and drivers the distance of a journey to Cork, which is at least 75 miles.

The bog country of Iveragh is seldom more than 6 miles distant from good manuring sand; much of it within one mile; and it is never far from earth or gravel. Each of these

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Advantages of hemp.

* Hemp appears to me an object particularly worthy of attention. It is well known to be an excellent preparative for wheat. The plant is likely to give rise to a variety of manufactures, which, by employing the population, will consume the produce of the country. The ready communication with the great dock-yards will take off all the manufactured produce, and the neighbourhood of the sea will furnish a supply of alkali for the conversion of the hemp-seed oil into soap, of which we have so long drawn such immense supplies from Russia, at an enormous expense.

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horses and drivers could could make from twelve to fifty journies, with sand or earth, during the time employed in making one journey to Cork. The six could therefore lay from 72 to 300 loads on in that time, which would be sufficient for at least one acre; and its produce after that cannot be reckoned at less than £. 3 per annum. Take this only at ten years purchase or £. 30.

Now the 10,000 journies of horse and driver are equivalent only to 1,430 journies of horse and cart, leaving 8,570 journies of horse and driver for the improvement of the country; and 1,430 acres thus improved every year, produce, at £. 30 each, a permanent benefit of £. 42,900. which may be repeated every year so long as there is land to improve. This immense sum, which may be said to be lost or wasted by the present improper direction of labour, may surprize those who have not turned their attention to such calculations. Yet I insist, that if examined with care, it will be found greatly under-rated; for the improvement must be supposed to be done with carts, which would increase the amount six or sevenfold, without a single additional horse or labourer being employed.

Other future improvements, how beneficial.

No future improvement on the means of transport could give many more hands to agriculture; but it would have another important effect, viz. the diminution of the expense of bringing to market; and therefore an encouragement to the raising of produce of greater bulk and smaller value, such as corn. This could bear the present expense of transport from that country, in no shape but that of spirits, which is there an article of import, and in fact constitutes a great proportion of the back carriage from Cork. But this barony, whenever its culture is increased, has the sea just at hand to bring its produce to the best market, without the necessity of looking to any intermediate emporium; and in that event the return of lyme, gypsum, or other manure, of which it is now destitute, will re-act powerfully on its present extensive wastes.

Planting well suited to his district.

Planting is a means of improvement particularly adapted to this district; fir is found in all the bogs in considerable abundance, and frequently with 5, 6, or more feet of turf below it; and oak is found at the bottom of most of the bogs. The whole of the Dunkerrin mountains are a stool of oak. This shows, at least, that the climate and soil are well enough adapted to timber; yet there is in the whole barony hardly a tree to be seen, excepting a few near Cahirbarna, and a pretty extensive copse in Glen Carrn. The original woods were destroyed by the iron forges, near a century ago; and no inclosures being made the stool of oak has been kept down by the continued depredations of cattle.

That it has not been extirpated may be inferred from this; that Mr. Jermyn, a farmer on Kenmare Bay, having inclosed a piece of rough ground by the sea-side, and planted forest trees, finds them nearly choaked by the rapid growth of the natural oak coppice wood. I may also observe, although not strictly in place, that Mr. Bland of Derriquin, and Mr. Irvine, who has planted for the Marquis of Lansdown, find no difficulty in raising fir and birch on any bog, whenever relieved from the surface water.

I should recommend, however, that the mountain ground and upland bogs, especially on the Cummara, Eeny and Carry, should be chiefly planted. The lower bogs seem fitted to give greater returns by other means. These are all rivers well adapted for floating and sawmills; and the facility of carriage to the great dock yards, will render the disposal of the timber at all times certain.

I have the honour to be,
Gentlemen,
Your very obedient Servant,
Alexander Nimmo.

Dublin, Dec. 27th, 1811.

The Killorglin Bog:

BEFORE leaving this Bog, it may be observed, that even the more unpromising parts of it are not out of the reach of a profitable cultivation. A Mr. Murphy has taken a lease of 1,400 acres of this Bog and the adjacent mountain, from Judge Day, and has already built a good many cottages on it. He limes at the rate of 100 barrels, which cost 33*s.* 4*d.* but with carriage, breaking and burning, come to about 7 *l.* 10*s.* per acre; then having drained and dug the field, which is not done under 50*s.* probably more, he takes one crop of potatoes, about three Kerry barrels of 21 pecks; the best giving in the country, 5*s.* 5*d.* let us call his 4*s.* 63 pecks, at 4*s.* per peck

us call his 4*s.* 63 pecks, at 4*s.* per peck - - - - -	£. 12. 12. —
Next crop better, say - - - - - - - -	16. — —
Next crop worse, say - - - - - - - - -	12. — —
A crop of oats, worth - - - - - - - -	10. — —

when he leaves it for meadow, and it pays in that state, a rent of £. 4. 11*s.* or four guineas per acre. He finds the Potatoes from Bog or earth much the same, his ground being mixed with moor, the first are not so dry, but larger and more productive.

Of the Drains for Bogs:

BY the foregoing Estimate, it appears that the drainage of 65,284 Irish acres = 105,749 English acres of Bogs in this County, may be effected for the sum of £. 70,041. 8*s.* 11*d.* which is at the rate of £. 1. 1*s.* 6*d.* Irish, per Irish acre; or 12*s.* 3*d.* sterling, per English acre.

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Though this may appear a small sum for effecting so great an object, I am perfectly satisfied that it is adequate to the purpose. I have, even in the prices for the different Drains, made some allowance for their being cleared or scoured subsequent to their first execution: I conceive this an important part of the operation; but it may be done at so small an expense, that it would be very injudicious to go to the charge of deep-sinking, by way of avoiding it. In none of these Drains do I suppose it necessary to go to a greater depth than six feet, unless in one or two instances to bleed a lake. By this, I mean their permanent or ultimate depth, which it would be very improper, however, to excavate in the first instance, especially in Red Bog, for the semi-fluid mass would undo the work nearly as fast as it was executed.

The proper way is to open a cut of one or two feet deep at first, and when that shall have to a certain extent, consolidated the surface, to deepen and widen it by degrees; we may go on that way until we arrive at the bottom of the deepest Bog in Ireland; but this, even if practicable, would very seldom be advisable. We might succeed in making a very good turf bank, but would run a great risk of unfitting the Bog for agriculture, especially if every supply of water was to be so cut off.

I have proposed these Drains only for places where there were no natural hollows or water-courses formed already, and where the flat Bog rendered it advisable to run a great many Fence Drains into one common sewer. In other cases, I have proposed the clearing and opening of swamps, not so much with regard to the neighbouring Bog (generally much higher) as in order to drain the swamps themselves; such places are well worth that operation, as they immediately throw up a luxuriance of grass.

In all the firmer Bogs, where there is a free declivity into the natural water-courses, I have estimated the surface draining at 10*s.* per acre. It is proper that I show how this may be performed.

The Bog must be laid out into regular inclosures, the size and figure of which will depend on various circumstances, of convenience or necessity; let us suppose them squares of ten Irish acres.

These fields must be separated by ditches, which, if they serve as the common outfall of several fields, must be sunk four feet in depth; but if the fall be quick, or the ditch does not receive any foreign waters, three feet in depth will be quite sufficient.

These ditches might be made with perpendicular sides, and will stand very well in Bog, as may be every where seen in the turf grounds; I prefer, however, making them with the slope of $\frac{4}{5}$ to 1, and only a foot wide at bottom, since that form appears less liable to choke up with herbage, &c. If they are intended to keep out sheep, they must be at least six feet wide at top, though it seems hardly fair to charge this additional excavation to the account of drainage, any more than the row of quicks, which it would be extremely advisable to plant along the side of them. At any rate, a perch of that kind of drain may be very well made for one shilling. In addition to this, if the Bog require it, let four small Drains of one foot in depth be made across the slope, leading into the side fences, giving them a fall in the bottom, if there be none in the ground; such furrows may be made for 1 ½ *d.* per perch.

We have then, for each field,

40	Perches head drain, - - -	at 1 *s.* - - -	£. 2
40	- D° - side - D° - - - -	1 *s.* - - -	2
160	- D° - cross-furrows - - -	1 ½ *d.* - -	1
	For 10 acres, is 10 *s.* per acre - - -		£. 5

When springs occur, which is but a rare occurrence in the Bogs, they should be taken off by a small drain, which, if the Bog is to be cultivated, may be covered. For this purpose, a well-dried turf will answer, if nothing else can be had. The ridges and furrows are to be drawn parallel to the side fences; and in general every shallow pool or receptacle for water should have an outlet formed for it.

From every observation which I have made in this District, comprehending Bogs perhaps of every possible variety, I am quite satisfied of the futility of any method of draining Bogs otherwise than by the surface, in the same manner that we drain clays; but with this advantage in the case of Bog, that the great evaporation from its rough surface, and the capillary attraction of its upper strata, will rapidly draw the water from the interior, when the foreign supply is otherwise provided for. If however the drainage of the lower strata be wished for (and there can be no doubt but it would tend to hasten the subsidence of the Bog) there may be auger-holes sunk at the sides of the Drains down to the gravel, and the core lifted out by the peat borer; and the gravel should by all means be tapped in the catch-water Drains under the moorlands.

The small Surface Drains recommended for the firmer Bogs in Iveragh, may with great propriety be applied to the wet uplands of Slieve Luaghar, or the mountain Bogs in the slate and rubble range. For this purpose, small cuts, of 1 foot to 18 inches deep, are only necessary, and should be led across the slope with only a gentle declivity, but continued perhaps for half a mile in length. They are marked out by the line, with a sharp straight spade, on both sides; the sods are then moved with a deep spade of one foot wide, and lifted by a crooked

(5.)
EXTRACTS
from the Appendixes to preceding Reports.

crooked fork; in this way, forty perches of these Drains may be made by one labourer in a day. This system of drainage has been carried on to a great extent on the borders of Scotland, and found to be attended with the most important effects in banishing the rot, and improving the pasture for sheep.

Rep. IV.
Mr. Nimmo.

Of the Formation of Soil upon Bog:

We have made but a small step towards the reclaiming of Bog when we have got it drained; it is merely converted into a heathy moor; and will by degrees afford pasture for sheep, or even heavy cattle, but it is so open and porous, that the grasses which it bears abundantly in spring, are frequently destroyed by the droughts of summer. To render it a permanent meadow and fit for agriculture, some much more expensive operations are required. The fibrous texture must be destroyed, and the Bog converted into a vegetable mould.

Top-dressings of gravel, clay-sand or sleech, may be laid on, where they can be conveniently got; they correct the porosity of the Bog, which is one of its greatest defects; clay in particular seems to act very powerfully upon Bog, after being burned or roasted.

The conveyance of these top-dressings over the Bog, is attended with much expense, since a layer of one inch in thickness cannot well be supplied under 6*d.* a cubic yard, or *£.* 5. 9*s.* per acre, even with the most favourable means of transport; and in many cases would perhaps cost three times that sum.

This method, however, becomes very advisable when the top-dressing can be laid on as alluvion or warp, by means of rivers, or the sea; and this is more frequently practicable than is perhaps imagined. Indeed Bog-stuff itself, which has been transported and thoroughly broken up by running water, is as valuable a soil as any other.

Where the situation will admit of it, the next best method is, to lay a field of Bog of given size under water, and bring the soil over it by flat boats. Embankments for that purpose may often be left in turf-cutting, or even if they are formed artificially, they will not much exceed the expense of stout fences. Rough hillocks or tufts should previously be cut off or burned, or the stuff may be floated into hollows. This method is especially applicable to the low-lying Bog on the rivers, which are embanked for warping, as it will much accelerate the benefit of that process.

When the declivity becomes too great for this method, the stuff which is brought into the Bog by a level canal with boats, may be spread out by waggons, wheelbarrows, &c. or it may be brought on at once by waggons and railways, or if within forty yards, by wheelbarrows alone, &c. &c. And if the subsoil can be got within three or four feet, it may be trenched up with the spade. By none of these methods can it be expected to cost less than 6*d.* a cubic yard. But the improvement which would thereby be produced on the Bog, would render it worth 15*s.* to 20*s.* per acre at the least; and if a dressing of hot lime were applied at the same time, the Bog would be worth 20*s.* to 30*s.* per acre, for pasture alone.

But we may form a vegetable soil of the Bog itself by cultivation and manure. It should be left, after draining, two or three years to consolidate; then it may be ploughed up by horses, or dug over with the spade, forming it into level ridges of two perches in breadth, and then followed by repeated ploughings and harrowing. Lime should then be applied at the rate of 60 to 100 barrels per acre, the Bog ploughed up for the seed left over winter, and oats or rape sown in spring.

The soil which is thus exposed to the vicissitudes of the weather, &c. has its astringent principles washed out, and its texture destroyed, it decomposes into a vegetable mould.

The only danger of the operation is, that as the ploughing can only be done in summer, the sods are apt to dry into turf ere their texture be altered, the operation should therefore be performed as late in the season as possible, that the sods may be speedily exposed to the winter frost and rains.

Where there is a command of water to be brought over the Bog, this alteration of the soil may be greatly accelerated; and if the water passes with rapidity, the finer particles of Bog-stuff which it transports, may be made to settle on a field below, and will be found a valuable alluvion. The acid and astringent principles being soluble, will pass away with the water, if it be not allowed, as at present, to lie until it be carried off by evaporation. Since the application of water may be made so useful, I have included all the more obvious cases in my estimates.

Lime appears to act chemically upon Bog. It may neutralize the acids; it rapidly dissolves the vegetable fibres, and converts the Bog into friable mould; it seems the best possible manure that can be applied, especially after the Bog has acquired some kind of green sward; if that is not the case, dung or earth should be applied with it, to encourage the grasses to rise. Lime slaked with salt water, is said to be unusually beneficial, and the farmers in applying shell-sand, universally prefer that which is washed by the tide. Every kind of calcareous manure seems beneficial in Bog improvement; and it is truly surprising to see the care with which the small farmers in the south apply the shell sand with bowls on their potatoe beds, nearly as thin as if they were sowing seed.

In

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In all cases of the cultivation of Bogs in Kerry, potatoes have been the first crop, and usually also the second. Dung of some kind is applied with the seed, and there is no complaint of any deficiency of produce. It cannot surely be expected that crops are to be got off any kind of land without manure, and it would therefore be unfair to charge the expense of it to the account of the reclaim of the Bog; it acts powerfully however on that substance, and were more pains taken to collect and preserve manure in Kerry, the quantity of Bog that might be soon reclaimed is very great. At present the dung is chiefly applied to the upland, and the reclaim of Bog is most observable where sea-weed and shell-sand can be easily procured. The fine limestone vale of the Cashen is particularly backward though provided abundantly with lime, a manure which can be multiplied at pleasure. The inhabitants seem perfectly ignorant that the chief sustenance of the southern part of the country is derived from a soil, which either is or has been, a Bog of as forbidding an aspect as any in their neighbourhood. The common method of preparation adopted by them is paring and burning, which is not improper for the rushy upland clays, but is absolute waste when applied to a red Bog; were the clay from the neighbourhood to be procured and burned in clamps or kilns with the Bog-stuff, it might be applied as manure with great advantage: it is only in that way that those ashes, which are heavy and red, seem to be of any benefit. They afford one good and one middling crop only; but as the deep Bog must be afterwards dug over with the spade, and not ploughed, it would be just as well to level the natural turf and improve it with potatoes and manure, or fallowing and lime. By so doing we preserve the whole stock of vegetable or carbonaceous matter for fuel, or the wants of future vegetation, instead of destroying or extirpating it, and having to regret its loss when it cannot be restored.

Of Crops for Bog:

As to the proper crops for bog, much information cannot be expected from the Engineer. It does not appear that any crop is peculiarly unfit for this kind of soil; and accordingly, that is cultivated which is chiefly in request in the country. In Ireland, potatoes; in Scotland, oats; in Germany, pulse; in England, wheat, or rye, are the most commonly tried, and all with success. In grazing districts, rape and turnip are favourable crops in the commencement; cabbages, carrots, &c. afford likewise great returns, and in general every kind of green crop seems to thrive well; so that the cultivator of bog appears to have as much latitude as he would in any other soil. It need only be observed, that frequent cropping renders bog perhaps too open and dry, while by too long continuance in pasture, unless the surface be carefully freed from stagnant water, the aquatics return, and the bog relapses, though never so much but that the effects of the first reclaiming are always visible. Alternate cropping and pasture are therefore most advisable upon bog as upon most other soil.

Upon the whole, I am so perfectly convinced of the practicability of converting the whole of the bogs that I have surveyed, into arable land, and that at an expense which need hardly ever exceed the gross value of one year's crop produced from them; that I declare myself willing, for a reasonable consideration, to undertake the drainage of any given piece of considerable extent, and the formation of its roads, for the sum of one guinea per acre; and to prepare the same, for the reception of any crop, for £. 10 per acre, which is little more than seven years purchase of the rent it would then afford. At this rate, the whole bogs I have surveyed in this district, about 150,000 English acres, might be converted into arable land, for about one million sterling.

Alexander Nimmo.

REP. IV. *Mr. Edgeworth*, on Bogs east of the Shannon; Plan for an Act of Parliament to oblige owners to ascertain their Boundaries.

Mr. Edgeworth's Report on Bogs east of the Shannon.

As the Board have, in their instructions, invited their Engineers to give their general opinions, I presume earnestly to entreat the Board to apply to Parliament for an Act to oblige the owners of bogs to have their bounds ascertained.

Till this be done no improvements can be attempted, because the present claimants, not knowing their own rights, and fearful of incurring enormous and unprofitable expense, if they attempt to ascertain them, decline entering into any engagements, when proposals are made to hire or purchase them.

Beside the Reports of the Board, short pamphlets and long books have been written on the drainage of bogs; some of these contain elaborate chemical, botanical, and agricultural enquiries into the constituent parts of bogs, and into their future mode of cultivation, when they shall have been converted into vegetable mould. Without entering into these disquisitions, it may be asserted, that some public experiment should be tried, that might demonstrate to the nation, either that the scheme for improving the bogs of Ireland is practicable, or hopeless.

Such an experiment would cost a mere trifle, compared with what has been already expended in ascertaining the extent of bog in Ireland; it would not amount, in the whole, to one-tenth of a penny for each acre in the island, and no further aid could ever be reasonably required.

The Engineers employed in conducting such an experiment, should not be allowed any salary or emolument, except what might arise from the bog which might be entrusted to their management; thus the alarming idea of a job would be avoided.

Nothing but such a plain and indisputable proof of the practicability and profit of reclaiming bog, is wanting, to turn the attention of individuals and of large companies, to this mode of enhancing private fortunes, and of increasing national wealth; and surely such a result arising from their labours, would be the most gratifying reward that could be conferred upon the members of your Board. They have gratuitously devoted much of their time and skill to this object, and they most anxiously wish that their labours may ultimately and indisputably become satisfactory to Parliament, and beneficial to their country.

REP. IV.—*Mr. Richard Griffith*, junior, on the Bogs in Galway and Roscommon near Athlone; sundry Improvements and Methods of reclaiming.

Mr. GRIFFITH on the Bogs of Galway and Roscommon.

Composition and Growth of Red Bog:

THE composition of the upper and lower bogs is exactly the same, and is similar to that described in my former reports, particularly in the section of the turf-bank in Timahoe bog;* that is, a regular gradation from a spongy moss to a compact mass resembling pitch or pitch coal. In the bog of Kilcashiel (one of the upper bogs) I had an opportunity of observing the annual increase in height or growth of a bog for twenty years, which, in the spot where I noticed the fact, was about two inches for each year; this may seem an extraordinary increase, but the situation appeared to be particularly favourable to the growth of moss.

Instance of the growth of Bog.

Twenty years ago, the water from a small lake situated close to the edge of the bog of Kilcashiel, was drawn off by a drain cut from the lake to a stream which runs beyond the edge of the bog; it was intended to improve the bog beneath the water, and that immediately adjoining the banks of the lake; the improvement was not followed up, and the drain was suffered in part to close; the bottom of the lake was now exposed to air, but the bog below remained still highly saturated with water; moss immediately began to vegetate, and has continued to increase in height ever since.

I was enabled clearly to observe this fact, from a turf bank having been cut into the place where the lake formerly was; and from the variety in the colour and texture, I calculated the annual growth of the moss with nearly as much accuracy as the age of the Scotch fir-tree may be determined, by observing the number of concentric rings visible when the stem is cut across.

Vast quantities of ancient timber have been discovered in some of the shallow bogs in this district, but no where in such abundance as in the bogs of Kilcashiel; the kinds most frequently met with are, oak, Scotch fir, and yew. Very large trees have frequently been found; I saw the stem of an oak tree which had been dug up at Clonshee, whose dimensions were 34 feet long, 4 feet diameter at base, and one foot six inches at top. The timber of the oak is always black, and when long exposed to air, it decays; but is excellent for under-ground or water-works.

The Scotch fir-trees are also very large, and appear to have grown to a great age. The timber is excellent for household purposes and laths. The yew found in the bogs has lately been much used for furniture, it resembles rose-wood, but is superior to it in beauty of colour and firmness of texture. The bog-timber is found lying in all directions, frequently at right angles to, and sometimes crossing each other.

Bog Improvements:

There have been many improvements of bog undertaken, and in part completed by several gentlemen in Ireland; but instances are very rare of red porous bog having been so highly improved as to resemble and possess most of the good qualities of upland, and to be superior to it in many respects.

Improvements at Woodlawn:

Improvements at Woodlawn.

The bog improvements at Woodlawn are amongst the most perfect that I have seen; they amount altogether to about 180 Irish acres, or nearly 292 English acres; 25 acres of which are under plantations, now growing with great vigour. These improvements were commenced about the year 1760, by the late Mr. Trench of Woodlawn, and have been continued, and I think I may say completely finished by his son, Lord Ashtown; they are particularly interesting, as they effectually contradict an assertion frequently made, that bog however reclaimed, will again return to its original state, if left undisturbed for a few years.

Commenced in the ear 1760.

Mr. *Arthur Young* in his tour through Ireland, has inserted an accurate description (written by Mr. Trench) of the method pursued in reclaiming these bogs. This account is so very interesting and distinct, that I have thought it right to extract it from Mr. Young's book, and to subjoin an account of the present state of the bog-fields at the conclusion of details of each experiment; together with the treatment it has received since Mr. Young was at Woodlawn.

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* See First Report of the Commissioners for the Improvement of Bogs in Ireland.

Extract from Mr. Young's Tour.

"* Mr. Trench's improvements at Woodlawn made me solicitous to view them; he was so obliging as to give me a full account of them; which is as follows:

No. 1. "The first method he took was with a bog of twelve acres, exceedingly wet, at the bottom of hills, sixteen feet deep to his knowledge; but he never was able to measure it to the bottom. A red bog, of a light fuzzy substance, like a bed of tow, which would not burn in turf; no other product than bog-berries; part of it so very wet, that he could not cut the drains at first wider than four feet and two spits deep; repeated this before the hard frost of 1765, had yet made no progress, it being almost as wet as ever, but took advantage of that frost to cover the ice two inches thick with clayey gravel; when the thaw came, the gravel sunk and pressed out the water; the expense of this manuring was £.3. 10s. per acre. This gravelling had such an effect, that in the May following above half of it bore horses with baskets for carrying on dung; and where it could not bear them, it was carried on by men; the quantity, six bushels to the square perch, and immediately planted with potatoes in the common trenching manner; the crop per acre, forty barrels, each 44 stone, at 8s. each. Levelled the potatoe trenches in digging for barley; in doing which, attended minutely to not burying the manure; this digging cost 30s. an acre; and the barley covered with the spade, which they do very fast, and the expense included in the 30s.; the crop of barley, ten barrels an acre at 8*s*. After this crop, took no more trouble with it; very rich and luxuriant grass sprang up directly, and would let readily in meadow at 25*s*.; but part of it in a few years would let at £.2. Two acres of it were not perfectly reclaimed, it was of the moory nature; dug and burnt it and put in turnips; the crop very good; then dug it for barley; the produce 14 barrels an acre, and the meadow very good ever since. I was over it, and found it a perfect improvement; the hay was fine, the herbage good, and carried the complete appearance of a meadow, except in the drains, where the heath still appears."

Present state of the Bog.

This bog improvement has now been made about 50 years. Seventeen years ago, it was manured by a light surface dressing, composed of the scouring of bog-drains, together with limestone, gravel, and some lime; it is now an excellent pasture for sheep or cattle, and has no apparent tendency to return to bog. The sod is so firm, that horsemen may ride over it without sinking in the least, or leaving any visible marks; the present depth varies from 10 to 18 feet; it must have been considerably more formerly.

Extract from Mr. Young's Tour.

No. 2. "Twenty-five acres of spongy fungous bog, from 8 to 16 feet deep, had been cut into very great turf-holes; which holes, though they held water, and had drowned many a cow, yet had so far drained the bog, as to make the less draining necessary; effected it, and then levelled the holes; but as they sunk much, levelled them a second time; upon this, took the advantage of a frost to manure it with clay and gravel, at £.2. 10s. per acre; then dunged a part with the quantity mentioned already, and the rest of it manured with the ashes of the moor, which burnt yellow; upon this manuring planted potatoes, the crop £.10 an acre; pretty equal, being as good after the ashes as after the dung. After the potatoes, levelled the trenches, dug it, and sowed wheat; the crop six barrels an acre; barley, ten barrels; oats, nine barrels; then left it for meadow; the value two pounds an acre."

Present state of this improvement.

This improvement has remained ever since in the state described above, and has never received any manure whatever, though part of it was formerly so wet that it yielded nothing but bog-berries; it is still called the "Bog-berry meadow."

Extract from Mr. Young's Tour.

No. 3. "Another piece of bog of the same sort, light and spongy, drained, and then manured with clayey limestone gravel, mixed with ditch earth. In the summer, planted potatoes; the crop, 15 barrels an acre; then dug for oats, six barrels an acre; meadow ever since, and perfectly good; would let at one pound ten shillings an acre."

Present state.

This field, which is called the "Rushy Bog," contains seven acres; it has been reclaimed 48 years; it was broken up this year for the first time, and manured for potatoes; the crop very good; its present value about £.2. 10s. per acre.

Extract from Mr. Young's Tour.

No. 4. "Another Bog of the same sort, perfectly well drained, manured with lime,
" 80 barrels an acre, at four pence per barrel; planted potatoes, the crop not worth digging;
" dug it for oats, the crop not worth reaping; then left it in grass, which was indifferent,
" not worth more than five shillings an acre."

Present state of No. 4.

This part is still less good than any of the foregoing; it has never received any additional manure; it is now in tolerably good pasture, but the grass is of a blue colour, and looks unhealthy. It may be doubted whether this is occasioned by the want of efficacy in the manure, as above described, or whether it be owing to an admixture of Bog iron ore, which this part of the Bog contains in great quantity.

Extract from Mr. Young's Tour.

No. 5. "Another experiment was on the same sort of Bog, which, when well drained,
" was manured in spring with limestone gravel, and then with marl instead of dung, and
" planted with potatoes; the crop worth four pounds an acre; then dug it for oats, the crop
" six barrels; and then left it to grass, worth one pound five shillings an acre."

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* See Young's Tour in Ireland, page 232.

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No. 6. " Another experiment, the same as the preceding, except lime instead of marl; " the effect in every respect on a par with the marl; neither of them yielded half the " produce which dung or ashes would have done."

No. 7. " Another Bog of the same sort was, after draining, manured with limestone " gravel, and then with the scouring of ditches and earth to the amount of three inches " and a half deep on the surface; expense in all, four pounds an acre; then left, and " nothing more done to it; very good grass the next season, worth for grazing 18 *s.* an " acre."

No. 8. " Another spongy Bog drained, and then well gravelled at £. 2. 10*s.* left so for " three years; scarce any grass came, the heath still remaining; planted potatoes on it " without any dung or other additional manure, the crop £. 4. an acre; then dug it smooth " and nothing sown in it, but came immediately to very good pasture, worth 15 *s.* an " acre."

Present state of the Improvements, Nos. 5, 6, 7, & 8.

I shall class Nos. 5, 6, 7 and 8 together, as I was not able to discover exactly the particular situations to which those numbers referred; they were however in different parts of what now forms two large fields. These fields have now been reclaimed thirty-five years; they have within the last four years gone through a course of tillage; the two first crops were turnips, manured with compost formed of ten loads of stable dung, and the remainder cleanings of ditches and limestone gravel, at the rate of 40 loads (7 cwt. each) per acre each year; the crops were excellent; the field was last year laid down (without manure) by a crop of oats with clover and rye-grass; the oat crop tolerably good, and the clover and rye-grass, particularly the clover, is very good. Several other extensive Bog fields have been improved within the last 20 years, which are all, except one, No. 8, in meadow and pasture both excellent; No. 8 was this year sown with turnips; the crop (excepting where some water lodged) is very good; it has been reclaimed 18 years.

Colour and specific gravity of reclaimed Bog soil.

The soil of these reclaimed Bogs, when first turned up, is of a dark brownish colour; its specific gravity, when compared with earthy soils, is certainly light, but it is much heavier than common Bog-stuff. The whole of the vegetable fibres have disappeared at the surface; however, at three feet deep, the mossy structure is still visible.

Bog plantations at Woodlawn.

The Bog plantations at Woodlawn are all in a very flourishing state; the trees in No. 9 grow partly on Bog and partly on upland; they have now been planted 55 years. I shall describe the size of the trees both on the Bog and upland, which as they are of the same age, may afford a tolerably fair comparison between the growth of trees in those different situations.

The average dimensions of the trees are as follow:

Comparative growth of timber on Bog and upland.

Ash on Bog, 1 foot 6 inches diameter at base; at the height of 20 feet, where the head branches off, one foot in diameter.

Ash on upland, 2 feet in diameter at base; at the height of 20 feet, about 1 foot 4 inches.

Spruce fir on Bog, 1 foot 4 inches diameter at base; at the height of 30 feet, 10 inches.

Spruce fir on upland, 2 feet diameter at base; at the height of 40 feet, 1 foot.

Beech on Bog, 1 foot in diameter at base; at the height of 20 feet, 6 inches.

Beech on upland, 2 feet in diameter at base; at the height of 20 feet, 1 foot 4 inches.

Observations.

In this plantation, the ash appear to have thriven the best; the roots of the trees growing on the Bog have not shot down, but have grown quite on the surface; some of them, particularly the ash, have formed a hillock of roots, above the general surface of the Bog; the top of the hillock is covered with soil, but at the sides the roots appear uncovered; they differ from common roots, as they are coated with a strong bark, similar to that which covers the stem of the tree.

Process observed preparatory to the plantations.

The other Plantations on Bog at Woodlawn, are from twenty to thirty years standing; they are composed chiefly of Scotch fir, larch, spruce fir, beech, and a few ash; previous to the trees being planted, the Bog had been drained and manured (according to the statement of Mr. Trench) with limestone gravel, and dung; a crop of potatoes was then taken, after which, the trees were planted on the top of the ridges. Some of the Scotch fir (where they had room) have grown very large at the base, but when that is the case, the stem is generally short; the average dimensions of the Scotch fir are 18 inches in diameter at base; at the height of 20 feet, 8 inches in diameter; larch 1 foot diameter at base; and at the height of 30 feet, 6 inches diameter. The beech and ash much smaller; spruce fir are of similar dimensions with the larch.

Average dimensions.

Plantations on Bog at Belview.

These plantations are of considerable extent; they are of different ages, twenty and thirty years. The trees most frequently met with are Scotch fir, larch, beech, alder, birch, &c. of which the Scotch fir and larch appear to have greatly exceeded the others in growth.

Preparatory process similar to that at Woodlawn.

The Bog was, for the most part, prepared for planting, by a mode similar to that adopted at Woodlawn; that is, by draining and gravelling the Bog, and afterwards manuring for a potatoe crop; the trees were planted on the top of the ridges, after the potatoes were dug out; in other places trees were planted on the Bog without any preparation, except draining; they have thriven well, but are not so large as those planted on the gravelled Bog.

Trees planted with gravel not so large.

The Scotch fir of thirty years growth, where they had room, have become very large, but the stems are short, seldom exceeding 15 or 16 feet in height; this may give them a handsome appearance as ornamental plantations, from their vigorous complexion, and their large heads; but they are much less valuable, on account of the shortness of the timber and the quantity of ground they occupy.

Scotch fir of 30 years growth.

Some of these short-stemmed Scotch fir of thirty years growth, are two feet in diameter at base; at the height of sixteen feet (the length of the stem) the diameter is one foot four inches; in other places, where the trees have been planted close together, they have grown much taller, but are less gross; their average diameter is one foot six inches at base; at the height of from 25 to 30 feet, from ten inches to one foot.

2 feet diameter at stem, and 1 ft. 4 in. at the height of 16 feet.

The Scotch fir trees planted twenty years ago, are on an average ten inches diameter at base, and twenty feet high. The larch trees, where they have been exposed to the northerly and westerly winds, have not succeeded as well as the Scotch fir; they have yielded to the westerly wind, and many have been killed by the blast; those planted to the southward and eastward of the plantations have grown well; some of them of thirty years standing are eighteen inches diameter at base, and forty feet high; their average is about one foot four inches diameter at base, and from 35 to 40 feet high.

Scotch fir of 20 years growth 1 ft. 6 in. at base, and 20 feet high. Larch of 30 years standing, average diameter 1 ft. 4 in. at base, and from 35 to 40 feet high.

The average of those planted but twenty years, is from ten inches to one foot base, and from 25 to 30 feet in height. The alder, beech, and birch, though planted at the same periods with the Scotch fir and larch, are not nearly as large, even at the south side of the plantations; but alder is very valuable as shelter for other trees, and should always be planted to the northern and western edges of Bog plantations. Among these plantations there are several opens where single trees have been planted (chiefly Scotch fir); in these cases the Bog is covered with excellent grass, which is mowed every year; in fact the only exterior circumstance by which the reclaimed Bog can be distinguished from the neighbouring upland is, by observing that the grass growing on the former is much thicker and longer, and apparently more luxuriant than that which grows on the upland.

Observations.

The grass on the improved Bog among the plantations, superior to that among the trees on the upland plantations.

Plantations of Scotch Fir on Bog at Tomoronco.

These plantations belong to Sir Richard St. George, Baronet; they are not large, but they are rendered remarkable by their uncommon growth, though planted on Bog merely drained, without any other preparation whatever. Scotch fir trees, four years old, were planted in the Bog six years ago; they are now, on an average, nine feet high. When the plantation was commenced, the surface of the Bog was covered with heath, which has since disappeared, and excellent natural grass has grown in its place. Adjoining this plantation, there was another attempted, nearly at the same time; the trees, when planted, were older; they consisted of Scotch fir, larch, and alder; they have, however, almost universally failed. This, at first view, appeared surprising, as the Bog was apparently similarly circumstanced with that where the trees succeeded so well, and from which it was separated merely by a drain; but on examining the sides of the drains, I found great quantities of Bog iron ore (in a decomposed state, containing sulphuric acid), near to the surface. It is not to be wondered at that the trees died away in such a soil. As this bed of iron ore seldom exceeds six inches in thickness, and is close to the surface, I think it probable that the Bog might be made to produce good green crops and grass, by simply ploughing deep enough to include the bed of iron ore, and afterwards burning the soil ploughed up.

Uncommon growth of trees on Bog merely drained, without clay, gravel or manure.

Failure of another plantation under apparently similar circumstances.

Supposed cause of the failure.

Reclamation of Bog at Clonfert.

The improvements on Bog made by the Bishop of Clonfert, though not very extensive, deserve attention from the very uninviting prospect which they held out previous to their drainage. The Bog of Clonfert, of which they form a part, is very wet, and is deeper and more extensive than any bog in that part of the country; and, upon the whole, exhibits a most unpromising appearance to the reclaimer of Bog. These disadvantages have not disheartened the Bishop of Clonfert; who has effected a valuable improvement by the common method of draining, and manuring with limestone gravel, or white shell marl, of which there is inexhaustible quantities along the banks of the Shannon. The crops which I saw on the Bog at Clonfert were wheat, oats and hay; the produce of the wheat crop was considerable, but the grain small, and not well coloured; the oats and meadow were both very good. The bog-fields are for the most part surrounded by double ditches, and plantations have been made, without any manure, in the spaces between them; the trees appear to be in a thriving state, particularly the Scotch fir, birch and poplar.

Unpromising appearance and extent of the Bog.

Process draining, limestone, gravel, and white marl.

Crops.—Wheat, the grain small and not well-coloured; produce considerable; oats and meadow, very good. Bog fields surrounded by plantations in a thriving state.

The Bishop of Clonfert has not preserved any account of the money that has been expended on this reclaimed Bog, which prevents my entering more minutely into the detail of those improvements. I have been more fortunate at Hodson's Bay; and I think the following account of the improvements at that place will be found interesting and instructive to all improvers of Bog.

No account preserved of the expense of improvements.

Improvements at Hodson's Bay.

The Bog Improvements at Hodson's Bay were commenced in the year 1797, on a small scale; but Mr. Hodson, finding it much to his advantage, has continued, every succeeding year, to reclaim a fresh piece of red bog.

Improvements commenced in 1797 on a small scale, and regularly enlarged every year since.

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The Bog of Hodson's Bay forms part of the great Bog of Curraghmore; it is now, however, separated from it by the road from Athlone to Roscommon. On examining those parts which still remain unreclaimed, I found them to be exactly similar to other red bogs, both in composition and depth. They are, however, much drier than is usual: this is owing to the road drains which have carried off a great portion of the water, and have consequently rendered the present drainage much less expensive.

Somewhat drier than other Red Bogs.

Dimensions and number of drains.

The dimensions and number of the drains which Mr. Hodson has found sufficient for the drainage of his Bog are,—

First.—Discharging drains 4 feet top, 1 foot 6 inches bottom, and 3 feet deep; these drains, with an allowance for second and third cleaning, cost him but sixpence a perch of seven yards lineal.

Second.—Surface drains, two feet top, one foot bottom, and one foot six inches deep, with the above allowances. These drains stood Mr. Hodson in but three-pence a perch.

Fields divided by drains into rectangles of about 5½ acres each field, expense of draining, 7s. per acre.

The discharging drains are cut through the bog in the direction of the fall, and are placed at the distance of one hundred yards from each other; the surface drains are cut at right angles to the discharging drains, and are placed at the distance of two hundred and fifty yards from each other. These drains divide the bog into rectangular fields of nearly 3½ Irish acres. The expense per acre of this drainage amounts to but seven shillings. Though the system of drains, as above described, may appear very trifling, they have answered perfectly well in the bog of Hodson's Bay; but they could not be expected to have any considerable effect in an extensive wet bog.

Mr. Hodson's mode of reclaiming Bog.

Process of improvement.
First year.

After the bog had become sufficiently solid by draining, Mr. Hodson drew out and spread 600 loads (each 6 cwt.) of limestone gravel of excellent quality, at three-pence per load, which is equal to £. 7. 10s. per acre. In addition to this, he also drew out from Athlone 60 loads of stable dung, which cost him £. 4. 10s. The dung was not intended to reclaim the bog; as Mr. Hodson considers the limestone gravel fully adequate to that purpose; but solely to increase the value of the first crop, which is always potatoes, and yields on an average 28 barrels of 42 stone per acre.

Second year.

The second year Mr. Hodson again covers the surface of the bog with limestone gravel, at the rate of 200 loads per acre; this cost him £. 2. 10s. He also lays out 30 loads of stable dung, which stands him in £. 2. 5s. He then plants a second crop of potatoes, which is always superior in quantity and quality to the first; the average product being 40 barrels of apple potatoes of 42 stone.

Third year.
Rye found preferable on Bog to oats or barley.

The third year Mr. Hodson lays down the Bog with rye and grass seeds. He prefers rye to oats or barley, as it never fails. He has found by experience that oats run too much to straw, and that the grain never fills; and that barley, unless in very particular seasons, yields a very moderate return. The produce of the rye crop, he found, on an average, to be eight barrels of twenty stone to the acre, and also two ton 8 cwt. of straw; which might be sold on an average for two guines a ton at Athlone; and Hodson's Bay is nearly three miles distant from that town. Mr. Hodson, however, makes use of his straw for manure.

Fourth year, meadow.

The fourth year, meadow, which is always excellent.

The following Account of the several items of Outlay, when contrasted with the Returns, will place the matter in a clear point of view.

Dr.—or Outlay.

	£.	s.	d	£.	s.	d.
First Year:						
Draining, per acre - - - - - - -	0	7	—			
Drawing out and spreading 600 loads of limestone gravel, each load 6 cwt. at three-pence per - - - -	7	10	—			
Ditto - - 60 loads of stable dung - - - -	4	10	—			
Planting potatoes - - - - - - -	2	8	—			
Digging and gathering ditto - - - - - - -	2	8	—			
Seed, 4 barrels of 16 stone each barrel, 42 stone at 10s. per	2	3	10			
Contingencies - - - - - - - - -	1	—	—			
Total Expenses of the First Year -	-		-	20	6	10
Second Year:						
Drawing out 200 loads of gravel as above - - -	2	10	0			
Ditto - - stable dung, 30 loads - - - - -	2	5	0			
Planting potatoes - - - - - - -	1	16	0			
Digging and gathering ditto - - - - - -	2	8	—			
Seed, as above - - - - - - - -	2	0	—			
Contingencies - - - - - - - - -	0	10	—			
Total Expenses of Second Year - -	-		-	11	9	—
Carried forward - -	-		-	31	15	10

	£.	s.	d.	£.	s.	d.
Brought forward	-		-	31	15	10
Third Year:						
Levelling potatoe ridges and sowing rye	2	—	—			
Sowing hay-seed	—	10	—			
Seed, rye, one barrel of 20 stone	1	—	—			
Eight barrels hay-seed, at 4s. per	1	12	—			
Reaping and threshing	1	9	—			
Contingencies	—	7	—			
Total Expenses of the Third Year	-		-	6	18	—
Fourth Year:						
Meadow, no expense; after which Mr. Hodson has let the bog for three years, at £.5 per acre, or for £.1. 10s. per acre on a lease of 21 years		—			—	
Total Expense of Four Years Cultivation	-		- £.	38	13	10
Cr.—or, Return.						
First Year:						
28 barrels of potatoes, common kind, generally white potatoes, each barrel 42 stone, at 10s. per	-		-	14	—	—
Second Year:						
40 barrels of 42 stone, apple potatoes at 14s. per	-		-	28	—	—
Third Year:						
8 barrels of rye, 20 stone per barrel, at £.1 per	8	—	—			
2 ton 8 cwt. of straw, at 2 guineas per	5	10	—	13	10	—
Fourth Year:						
Meadow lets for				5	—	—
Total amount of Return on the Crops of Four Years				60	10	—
Total Expenditure on Four Years Cultivation				38	13	10
Profit of one Acre of Bog for Four Years			£.	21	16	2

From the foregoing statement it appears, that Mr. Hodson has a return of £. 5. 9s. per acre per annum profit on his reclaimed bog for four years; and further, that the bog is at the end of that period of such value as to let as meadow ground for three years at the rate of £.5 per acre per annum; or if let on a lease of 21 years at £.1. 10 s. per acre.

Profits arising from the foregoing process.

A man of the name of Quigley, who lives on the north side of Barrymore Hill, pays three guineas per acre for reclaimed Bog of similar quality to Mr. Hodson's; with the exception, that Mr. Hodson's Bog has excellent limestone gravel close to it, and Quigley has none; yet this man appears to be perfectly satisfied with his bargain, and says he would be sorry to part with it. He has a lease of 21 years.

Reclaimed Bog let on a lease of 21 years, for 3 guineas per acre per annum.

Plantations at Hodson's Bay.

These plantations were commenced eleven years ago; they consist of Scotch fir, larch, spruce fir, birch, alder, oak, ash, and Canadian poplar. The trees were planted partly on prepared potatoe ground, and partly on drained red bog. Those in the potatoe ground were planted after the digging of the first crop in the furrows; and the other crops, viz. the second potatoe crop and the rye and grass followed in the same manner as if the trees were not planted; and as there was no ploughing (every thing being done by the spade) the trees were not injured. The larch and Scotch fir have succeeded the best. Larch planted eleven years, are fourteen feet high, and four inches diameter at base; Scotch fir of equal standing, twelve feet high, and six inches in diameter at base; the other trees are much smaller, except the Canadian poplar, which grows remarkably fast. The trees planted on the unprepared bog are Scotch fir and birch; as yet they appear to have thriven nearly as well as on the prepared bog.

Plantations made eleven years ago;

Larch and Scotch fir succeeded best.

I am indebted to Mr. Hodson for the chief part of the details contained in the above description of his improvements on bog; fearing, however, that I might have misunder-

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stood him in any point, I have submitted the foregoing paper to his consideration, and he returned it to me in its present state as perfectly correct.

Reclaimed Bog on the West side of the Shannon close to Athlone.

260 Irish acres of reclaimed bog sets on an average at 3 guineas per acre per annum; other improved Bog at 3 *l.* per acre, while upland adjoining these, sets for no more than 1 *l.* 10 *s.* per acre.

The upland on the west side of the River Shannon, in the neighbourhood of the town of Athlone, is entirely composed of ridges of limestone gravel, with scarcely any vegetable mould on the surface; manure is thrown away on such a soil, as, owing to the very porous stratum below, it disappears after one crop. This circumstance led the inhabitants of Athlone to attempt improving the bog at the base of the gravel hills, and the result has surpassed their most sanguine expectations; I was not able to ascertain the period when these bog improvements were commenced, but they are not of very ancient date. The extent of the improvement to the south of the fort of Athlone is 260 Irish acres, or 416 English acres, which sets on an average at three guineas per Irish acre; that to the north of the fort, as far as the hill of Barrymore, sets on an average for £.3 an acre, whilst the upland hills only let at the rate of £.1 10*s.* per acre. The chief manures used in reclaiming these bogs, is dung from Athlone; and where the bog is near the hills limestone gravel is also used. The rotation of crops is exactly similar to Mr. Hodson's, except that oats are substituted for rye. The difficulty of procuring long leases, is the only impediment to the great extension of the bog improvements in the neighbourhood of Athlone.

Difficulty of procuring long leases retards improvement.

Number and Dimensions of Drains proposed. *

In laying out drains for the improvement of the bogs contained in the district of the River Suck, I have followed exactly the system I recommended in my second report on the district of the River Barrow; which is as follows: The first class are main drains, which are placed in the lowest situations. Their dimensions are proposed to be fourteen feet top, two feet bottom, and twelve feet deep; but these large drains are never required, except when a number of minor drains are necessarily pointed to a situation where there is no natural stream; this so rarely occurs, that in the whole district of the River Suck, I have not found it necessary to lay out any main drains. Into the main drains, smaller ones, which I have called minor drains, are proposed to be cut, generally obliquely from the summits of the bogs to the main drains, or the natural streams, so as to take advantage of the greatest possible fall: their dimensions are nine feet top, one foot bottom, and eight feet deep: These minor drains are proposed to be carried at the distance of a quarter of an Irish mile from each other. Intermediate between the minor drains, it is proposed to cut drains of still smaller dimensions; viz. six feet top, one foot bottom, and five feet deep; and further, at right angles to the minor and intermediate drains, a system of cross drains of similar dimensions with the intermediate drains, is proposed to be carried 280 yards asunder, which would divide the bog into square fields of ten Irish acres.

The third class of drains being surface drains, are intended to divide the ten-acre fields into three parts, by two drains, to be cut parallel to the minor and intermediate drains, that is, in the direction of the fall. The whole of the foregoing drains, if executed, would divide the bog into rectangular patches 280 yards long by 93$\frac{1}{3}$ broad, which is equal to 3$\frac{1}{3}$ Irish acres.

The dimensions of the surface-drains are four feet top, one foot bottom, and three feet deep.

REP. IV. Mr. *Richard Griffith*, junior, on the Mountains of Dublin and Wicklow; general Observations on Mountains; Fiorin Grass, &c.

Mr. GRIFFITH on the Mountains of Dublin and Wicklow.

THE rapid rise in the price of corn, and in fact of all agricultural produce, has of late years, induced some gentlemen to attempt the improvement of boggy and waste lands; and essays, proving the benefit which would accrue from such improvements, have appeared in the Transactions of many of the Agricultural Societies in the United Kingdom.

Most of these Essays have laid down rules for reclaiming the lands of which they treat; but those rules are not in general applicable in detail to the improvement of the Wicklow mountains, which differ in climate and local circumstances from all other uncultivated districts with which I am acquainted. These peculiarities will be described at length in the progress of the Report;—they consist chiefly in the facility of access to the uncultivated parts, by means of roads, the vicinity of highly improved lands and industrious inhabitants; the frequent occurrence of beds of limestone gravel and marl, the best manure for the amelioration of mountain soils; and, lastly, the uncommon mildness of the climate.

It is impossible to lay down any system of improvement, which is equally applicable to the reclamation of a flat mountain summit, a steep declivity, a deep valley, or the several approximations to each of these extremes; a few general observations may however prove beneficial.

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* In my Report on the Eastern Division of District No. (I,) I have given a Section of the form, and description of the process which I should recommend to be adopted in sinking main drains. See page 33, First Report of Commissioners for Drainage of Bogs in Ireland.

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If the summit of a mountain be flat and boggy, the first object should be to drain it; the mode of effecting which will depend on whether the moisture be occasioned by condensed vapours, or by springs of water issuing from fissures in the rock; if the latter, the direction and dip of the stratification of the mountain should first be ascertained, as by this knowledge we shall be enabled to determine the proper situation and direction of intercepting drains, to cut off the water from the springs, and discharge it into the nearest valley, or make use of it for irrigation, if it be thought advisable. In many instances, these intercepting drains will be found sufficient; but if they are not, surface-drains one foot deep, and as narrow as they can be made, should be cut from 20 to 50 yards asunder. In cases where there are no springs, these latter, with proper discharging drains, are all that is requisite.

Having effected the draining, the next object is to consider the nature and depth of the bog or moory soil, and the immediate substratum; if the bog or moor yield yellow or red ashes when burned, the drain-surface should be ploughed, and afterwards gathered into heaps, and burned; this being done, the ashes should be spread,and grass-seeds sown; the result will be, excellent pasture in the course of two years. If the ashes be white, clay from beneath the bog should be mixed with the turf, previous to burning; but this will not answer, owing to the increased expense, if the bog exceed 3 feet in depth.

On the precipitous sides of mountains, where ploughing would be difficult, I should recommend that intercepting drains be cut nearly on a level along the face of the declivity, to catch the water which may fall from the summit, and these drains will be found sufficient, without other aid, to render the surface comparatively fertile, as I have observed a much greater natural tendency to the growth of grass on the sides of mountains than on flat bogs.

In the bottom of deep valleys any species of cultivation may be followed, as the soil is generally capable of producing every kind of grain; however, great care is here requisite to render the drainage perfect, and in all instances, catch-water drains must be cut along the base of the declivities to intercept the water falling from the mountain sides; limestone gravel or marl is frequently met with in the valleys; where the surface is boggy, it is generally of the compact kind, which yields red ashes, a manure superior to all others for the productions of green crops.

There is one general observation, which is equally applicable to all uncultivated mountains and valleys; viz. that all situations are capable of improvement where the soil is deep and wet, and where water can be removed at pleasure; but in those places where the soil is dry and light, little can be done, except by irrigation, and that will not be found to answer unless water be in abundance, which rarely happens in such cases.

Fiorin Grass.

This most useful grass, first brought into notice by the indefatigable exertions of Dr. Richardson, has lately acquired so much celebrity in the agricultural world, that I think it necessary to say a few words respecting its nature and properties; especially as the greater part of the flat moory valleys and gentle declivities of the uncultivated mountains of the county of Wicklow, seem peculiarly adapted to its production.

Many experiments have already been made on the cultivation of this grass, some of which have been unsuccessful, from various causes, but generally from the ignorance of experimentors, in planting grasses which were not the true *Agrostis Stolenifera* or Fiorin grass; indeed great difficulty appears to exist in distinguishing it, even amongst botanists, from the *Agrostis Alba*; which, though similar in many of its external characters, possesses none of the nutritive properties for which the true Fiorin grass has obtained such just celebrity.

Dr. Thornton, a Member of the Royal College of Physicians in London, has lately written a Paper in "*The Farmer's Journal*," on this subject: I shall extract that part of it which describes the distinguishing characteristics of the *Agrostis Stolenifera* and *Agrostis Alba*; and which points out also a difference in the Fiorin grass itself, which cannot be too carefully attended to in its cultivation.

"In the *Stolenifera*, the fibres are very much branched; in the *Alba*, they descend straight; in the *Stolenifera* the vagina of the leaves, or that which covers the culm, is striated or furrowed; and in the *Alba*, smooth: the stipules of the *Stolenifera* are many-cleft; in the *Alba*, bifid; valves of the calyx in the *Stolenifera* are acute; in the *Alba*, obtuse; petals in the *Stolenifera* obtuse; in the *Alba*, acute; if awned, the arista of the *Stolenifera* arises at the base; in the *Alba*, near the apex: to which we may add, stem hollow betwixt the points, which are closer and fewer. *Alba*, solid and more distant *Stolenifera*: which last circumstance accounts for its containing such a quantity of saccharine matter, like the sugar-cane, and being so tenacious of life, for when cut, after several months it will look green, and even vegetate, if hung up in the house. It is this circumstance which renders this grass such excellent winter food, instead of turnips and carrots, and so salubrious to cattle, and which will account for Doctor Richardson's making hay, or rather cutting down this grass in the month of November. It is said, by Mr. Curwen, to yield 20 tons of green food yearly per acre."

"In the Subscription Botanic Garden of Mr. Salisbury, in Sloane-street, the *Agrostis Alba* and *Stolenifera* are placed in patches near each other, and the Irish Fiorin grass in an-

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other place: and all the gardeners there are persuaded, that the Irish and English Fiorin grasses essentially differ; and the least observant eye must remark a superior degree of perfection in the former grass; and all those who have examined Doctor Richardson's specimen, notice a great superiority over such grasses as have been sold at even five shillings a plant, and distributed over the country as the true Fiorin grass, collected at Bagshot Heath, and other parts: I believe it to be a distinct variety; and it is of the utmost importance that Doctor Richardson should *stand* or *fall* by the *grass* he has cultivated; and the world is much indebted to that philanthropist for the vast pains he has taken to diffuse a true knowledge of the subject.

According to the analysis made by the Honourable Mr. George Knox, Fiorin grass contains 25 per cent of very sweet nutritious matter soluble in water, of which ten per cent appears to be saccharine matter, or a substance very much resembling sugar. From one pound of the sweet extract, when properly fermented and distilled, four ounces of strong spirits, specific gravity 930, were obtained, which is in the proportion of one ounce measure of spirit for every pound of grass. This product was obtained from experiments made on a small scale: when tried on a larger, six pounds of grass was found to produce one pint of moderately strong spirit, in flavour very much resembling whiskey, but of the two, rather preferable. Sir Humphry Davy has also been lately engaged in making comparative experiments on the grasses. His results, as I have been informed, for they are not yet published, do not exactly coincide with those of Mr. Knox. From 1,000 parts of Fiorin grass, Sir Humphry Davy obtained 76 parts of nutritive matter, of which 64 was mucilage, or starch, 8 sugar, 1 gluten, and 3 extract. Fertile meadow grass and sweet-scented soft grass, were the only ones that produced more nutritive matter than fiorin; 78 parts in 1,000 were the product of the former, and 82 of the latter, but neither of them gave so much sugar, the first yielding *five* parts, and the latter *four*. From these data it appears, that Fiorin grass, though inferior to the foregoing in the quantity of nutritious matter, is greatly superior in the quantity of saccharine matter; and if Sir Humphry Davy's experiments had been made on Doctor Richardson's Fiorin grass, which, as already observed, is superior to the English, it is probable that his results would have agreed with Mr. Knox's, and if so, it would have appeared that the quantity of nutritious as well as saccharine matter contained in the Fiorin grass, would greatly exceed that of any of the other grasses.

There appears to be great variety of opinion as to the proper situations for planting Fiorin grass. Doctor Richardson seems to think it will flourish every where, even on the summits of lofty mountains. This, I fear, is rather doubtful; and whenever the experiment is tried, it should be conducted with the greatest care and skill, as so much prejudice exists against the introduction of every thing which is new, that any want of success in experiments made on Fiorin, may prove highly injurious to its general adoption: in such cases, few enquiries are made as to the peculiar soil or situation, in which the experiment has failed, or the mode of cultivation that may have caused its failure; but the general impression remains, that Fiorin grass does not merit the high character it has obtained.

In preparing the soil for this grass, the greatest care should be taken to keep it clean and free from weeds, otherwise the young plants, which are very delicate, will be destroyed; but if kept perfectly free from other plants in the beginning, it will soon extend itself and mat on the surface, to the total exclusion of other grasses or weeds: moist situations appear to be peculiarly adapted to its growth; it is therefore superior to all others for reclaimed Bogs, moor, or water meadows; but if highly manured, immense crops of it may be obtained on dry upland; and where distillation is the object, it is probable that grass so obtained will be found superior to that raised on moist situations.

The best preparation of Bog or moor for this grass, is burning the surface. On upland, it should be planted in drills, after a potatoe or turnip crop. The grass should be cut down about the end of October, and care should be taken to expose it to the wind for a few days, to prevent any ill effects arising from the putrefaction of the sheath and side leaves.

REP. IV.—Mr. *Richard Griffith*, junior, on Tyrawley in Mayo, and Tyrerah in Sligo; probable origin of Bogs, &c.

Mr. *Richard Griffith*, junior, one the Baronies of Tyrawley and Tyreragh.

Speaking very generally, the boundaries of this great limestone valley may be traced on the northern side by a line drawn from Dublin Bay, and passing by Navan, Granard and Longford, to Carrick-on Shannon, and afterwards by Boyle to Colooney, Foxford, and Castlebar. The southern boundary is not so easily traced, as there are several ramifications from it passing by narrow isthmuses between primary and other formations.

Departing again from Dublin Bay, the southern boundary may be described by a line drawn from thence by Milltown, through Newcastle and the Red Hill, in the county of Kildare to Brown's Hill, which is two miles to the east of Carlow, on the river Barrow. At this place, the limestone valley becomes very narrow, and passes between the granite country of the county Carlow, which it overlays and the Kilkenny coal district, which lays over it. At Gore's bridge this limestone valley expands, and afterwards branches off into the counties of Kilkenny and Tipperary.

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Commencing again at Carlow, the boundary of the limestone valley passes four miles to the south of Athy, from whence it again ramifies into the county of Tipperary, forming a valley, almost twelve miles wide, between the coal district and the Slieve Bloom mountains. From Mountmellick the limestone boundary may be traced to the west by Ballybog, Dunkerrin, and having crossed Lough Derg by Woodfort and Toberdony to Galway Bay, from whence, turning northwards, the boundary line passes through Lough Corril and Lough Mesk, to Castlebar.

This great limestone valley, which includes one-fourth part of Ireland, contains above seven hundred thousand acres of Red Bog, the whole of which is improveable; for in every instance in the immediate neighbourhood of the Bogs, the best possible manure, viz. limestone gravel, is found. This is a fact of very great importance, and should never be forgotten by those who, at a future period, may take into consideration the general improvement of the Bogs of Ireland.

It is singular that the boundaries of the great limestone valley, as above described, should so nearly coincide with the boundaries you have given, in your First Report to Parliament, of the great belt which crosses Ireland from east to west, and which, according to your statement, contains six-sevenths of the Bogs of this country *.

In the foregoing pages I have given a geological outline of the baronies of Erris, Tyrawley, and Burrishoole, in the county of Mayo, and Tyreragh in the county of Sligo. The descriptions are for the most part very general; but I had neither time nor opportunity of making any very particular observations; my object in putting it forth is merely to give some idea of the geology of a country, which, in its present state, is nearly inaccessible, and which has never before been visited by any geologist.

The mountainous district of Erris and Tyrawley contains altogether about 295,000 Irish, or 477,850 English acres, of which about 94,000 Irish, or 152,260 Irish acres, are in a state of cultivation, or covered with sand; 96,000 Irish, or 155,500 English acres, are nearly unproductive mountain; and 105,000 Irish, or 170,090 English acres, are unprofitable red Bog.

Probable origin of the Bogs.

In considering what may be the specific difference between the deep lowland Bogs, contained in the great limestone valley of Ireland, already described, and that usually met with in mountainous districts, we are naturally led to the consideration of first causes.

Most authors who have lately written on the subject of peat moss, have agreed, that this substance will only vegetate at a low temperature, and where water is present. Admitting this to be the fact, all Bogs must necessarily have had the same origin; that is, wherever they have grown, temperature must have been at a low degree, and water, more or less abundant, must have been present: but Bogs are found in situations so very dissimilar, that we are next led to the consideration of the causes which equally induced the growth of the substance on the summit of a mountain, and on the surface of a country moderately elevated above the sea.

It is now generally known, that nearly the whole of the surface of the great limestone valley of Ireland is covered by a stratum, of various thickness, of limestone gravel; and that all the Bogs contained therein are surrounded by steep ridges of hills, formed of this substance, which prevent the immediate discharge of the waters into the nearest river. I mentioned this circumstance in the first Report which I had the honour of laying before you; and it has been corroborated by the Reports of all the Engineers that have been employed in levelling and surveying the Bogs, both on the east and west sides of the river Shannon.

These gravel ridges, which were probably formed by eddies at the time of the general flood, created an interruption in the currents of the waters, and thereby caused the formation of vast shallow lakes between the ridges of limestone gravel: in the stagnant lakes, mosses and other aquatic plants vegetated; for in the climate of Ireland, the temperature of stagnant water, at the level of the sea, is sufficiently low to induce the growth of moss during nine months in the year.

The growth of aquatics on elevated land, in this country, is rarely interrupted; the temperature is at all times low, and the slowness of evaporation, which is the consequence of a low temperature, leaves sufficient moisture, even on the sides of mountains, to induce the growth of moss in such situations; but the quantity of stagnant moisture in those places is trifling, when compared with the supposed shallow lakes which originally caused the growth of lowland Bogs.

It may be observed, that the depths of mountain and lowland Bogs are very different; the former rarely exceeds six feet, whilst the average of the latter amounts to twenty, and is sometimes more than forty feet in depth. This may at first sight appear extraordinary; for if my argument be correct, it is certain that the shallow Bog must have commenced its growth immediately subsequent to the formation of the mountains, and that the growth of the deep or lowland Bogs was commenced at a much later period; but it should be recollected, that moss will grow in some situations much more quickly than in others; and there

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* The belt is contained between a line drawn from Wicklow head to Galway, and another from Howth to Sligo. See First Report of Commissioners for improvement of Bogs, &c. page 4.

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have been instances (one of which I have mentioned in my Report on the district of the River Suck) of the growth of moss in lowland Bog amounting to two inches in a year for twenty years. This rapid growth of moss may perhaps be attributed to the great abundance of stagnant water which is always present in the lowland Bogs, excepting in the hottest of the summer months.

Mountain Bog is much denser than lowland moss; this is the natural consequence of the difference in the rapidity of the growth of each.

REP. IV.—Mr. *Nimmo* on the Bogs of Galway, West of Lough Corrib; various modes of culture, with comparison of expense.

Mr. NIMMO on the Bogs of Galway, West of Lough Corrib.

Of the Cultivation of Bog.

I am perfectly convinced, from all that I have seen, that any species of Bog is by tillage and manure capable of being converted into soil, fit for the support of plants of every description; and with due management, perhaps the most fertile that can be submitted to the operations of the farmer.

Green crops, such as rape, cabbages, and turnips, &c. may be raised with the greatest success on firm bog, with no other manure than the ashes of the same soil. Permanent meadows may be formed on Bog, more productive than on any other soil. Timber may be raised, especially firs, larch, spruce, and all the aquatics on deep Bog, and the plantations are fenced at little expense; and with a due application of manure, every description of white crops may be raised upon Bog; and I know no soil from which they can be extracted without it.

There is this advantage in the cultivation of Bog, that any species of soil will act as a manure to it, even the siliceous sand of Renvill having that effect; but this admixture of foreign soil, though highly beneficial, is not essential to the improvement of Bog; fallowing and manure, such as dung or lime, will convert the Bog-stuff itself into a soil, and extract large crops from it; so that there is nothing desperate in the cultivation of Bog upon the basis of a rock.

Bog-stuff is also of great value as a manure, either by mixing it in compost with kelp, lime, or dung, or by soaking it with putrid or salt water, or even rain or river water, provided its texture is well broken. In the limestone counties round Lough Corrib, the lower part of the Bog-stuff or "moreen," as it is called, is much used as manure, after being some time exposed to air and moisture. Turf ashes are also well known as a valuable manure, either on firm Bog or clayey upland.

The first operation necessary in the cultivation of Bogs, is drainage. It should be so managed, as to have also the effect of inclosing; and in most cases it may be made to facilitate the formation of roads and small canals, on the application of water.

Where the bogs have much inequality of surface, the position of drains and inclosures will be regulated by circumstances; care must always be taken to cut off the upper and foreign water, by a catch-drain under the banks, ere it spread on any part of the level bog and to have an appropriate channel for carrying off the water from every hollow on the surface.

Bog-stuff being impermeable to water, cannot be drained through the under strata.

In the greater level bogs, I would still recommend a subdivision into square compartments of ten acres each, by ditches or drains 6 feet wide at top, and 4 or 5 feet deep. Then small cross-drains or furrows, at 7 or 8 perches asunder, parallel to that side which has least fall, of 1 foot wide and a foot or more in depth, giving them a fall in the bottom, if there be none in ground.

The drains must be allowed, especially in wet bogs, to run for a year or two ere any thing farther be attempted; they must be annually scoured, and preserved of their proper depth.

If dung is to be had, the best system is undoubtedly to plant potatoes, either in beds or drills; the furrows running down the fall, will complete the drainage, and the manipulations of the potatoe-crop hasten the formation of the soil; or instead of potatoes, a crop of turnips, carrots or greens, may be taken.

A slight addition of dung gives a second crop of potatoes, for which, if the former was in beds, the furrows must now be changed to complete the formation of the soil.

The trenches being then levelled, so as not to bury the improved soil, the land is sown with a white crop, as oats, rye, wheat, &c. laid down with grass seeds; and when in grass, a top-dressing of lime, gravel, earth or sand applied. After 3 or 4 years meadow and pasture, it is again broken up, and the second rotation of crops will greatly exceed the first in value.

Estimate

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Mr. Nimmo.

Estimate of the Outlay and Return of the First Rotation for the system of Potatoes and Manure on a Ten Acre Field.

	£.	s.	d.	£.	s.	d.
80 perches boundary drain, at 1*s.*	4	—	—			
160 perches cross drains, at 1½*d.*	1	—	—			
Trenching and forming ridges, 5*l.* per acre	50	—	—			
Twenty tons dung or sea-weed, per acre 5*s.*	50	—	—			
Seed 2*l.* per acre	20	—	—			
Planting, earthing, digging, &c. 5*l.*	50	—	—			
Total Outlay - - £.	175	—	—			
Return, 7 tons, or 1,120 stones potatoes, per acre at 3*d.*	-	-	-	140	—	—
Second Year Potatoes again.						
Ten tons dung, per acre	25	—	—			
Seed and labour	70	—	—			
Outlay - - £.	95	—	—			
Return, 1,500 stones potatoes, per acre at 3*d.*	-	-	-	182	10	—
Third Year, White Crop (Oats) with Grass seeds.						
Seed oats, per acre, 1 guinea	11	7	6			
50 lbs. of clover and rye, grass seed, &c. per ditto	25	—	—			
Hoeing, barrowing, rolling, &c. 3*l.* 10*s.* per acre	35	—	—			
Reaping, &c. paid by straw.						
Outlay - - £.	71	7	6			
Return, 200 stone of oats, per acre, at 1*s.*	-	-	-	100	—	—
4th year, meadows, at 5*l.* per acre	-	-	-	50	—	—
5th ditto, second year	-	-	-	50	—	—
Total Return on White Crop, &c.	-	-	-	200	—	—
Total Outlay and Return for these 5 years	341	7	6	522	10	—
Top-dressing of lime, coral, gravel, &c. which suppose to cost 10*l.* per acre	100	—	—			
	441	7	6			
Gained in 5 years - - £.	81	2	6			
£.	522	10	—			

Which is more than 8 per cent. on the capital employed; suppose 200*l.*

The land now in pasture will let at 30*s.* or upwards per acre per annum.

Where dung is scanty, and earthy limestone gravel to be had, as is the case with so many of the Bogs in Connaught and Leinster, a top-dressing of that substance should be applied as early as possible in the process; if that is not to be had, then clay burnt, if possible; if none of that, then any gravel, earth, rotten rock or sand. This will greatly change the vegetation on the bog, and render it good pasture, without much manipulation. If accompanied with a dressing of half half-slacked quick-lime and of red ashes, the value will be much greater, and the preceding rotation of crops may be taken without much farther manuring.

But the great original outlay, and the difficulty of transporting these substances over the bog, are serious obstacles to this system, especially in a country where capital is not abundant. The means of facilitating it is the proper business of the Engineer.

Where the foreign soil can be applied, as the alluvion of rivers and streams, it is the cheapest of all.

The next best is a water-carriage over the whole surface. I have shewn that this is practicable in bogs of any slope, but is particularly adapted to level bogs.

A partial water-carriage will be of service when the distance is great; level canals being run into the bog from the gravel-pits, and the stuff spread out on the bog by wheelbarrows, waggons, &c.

The different modes of land carriage require no comment.

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By none of these methods is it likely that a dressing of an inch in depth can be applied under about 8*l.* per acre, unless the bog be firm, and very near the gravel. A dressing of 100 barrels of lime would cost 5*l.* or upwards, so that the capital or original outlay in this system may be considered as at least one-half greater than in the former. The returns and ultimate profit will be much the same.

When this system is adopted, I would therefore recommend it to be combined with an extensive cultivation of rape or turnip on the rest of the bog; and this to be manured with the ashes of the turf, cut away for facilitating the water-carriage.

This, as observed by Mr. Griffith, is a cheap method of rendering bog productive; but instead of pasturing it with sheep, I would advise it to be given to soil cattle in the house, or in folds, as the manure produced thereby will be of great service in extending the cultivation.

An acre of rape or turnip will be at least worth 10*l.* for green food; the expense may be as follows:

	£.	*s.*	*d.*
Draining, per acre - - - - - - - - -	—	10	—
Ploughing, &c. - - - - - - - - -	1	—	—
Digging up, burning, and spreading ashes - - -	2	10	—
Seed 2 *s.* 6*d.* harrowing or rolling, &c. - - - -	1	—	—
Cutting and carrying home, or attending sheep, if fed off -	1	10	—
	£.6	10	—

If the Bog cannot be ploughed, the expense of digging with spades, and ridging, will cost about £. 4, but the rape or turnip crop will still cover it.

The only other system I shall now notice is, that of fallowing and liming. It seems best adapted to those parts of Jar Connaught, &c. which are destitute of manure, and where the sub-soil is rock.

In this mode, which has been followed in Scotland with some success, the surface drains are first made, and allowed to run for two or three years, when the Bog becomes sufficiently firm to bear horses in summer; it is then to be ploughed up, and exposed to the winter frosts and rains: this being repeated several times, so as to pulverize the soil, it is formed into broad level ridges, dressed with lime, ploughed for the seed in autumn, and sown in spring with oats. A second crop of oats is sometimes taken, and the land laid down in grass. After three or four years, break it up again for oats on the lea; potatoes or turnips, with dung; barley, with grass seeds, hay, &c.

I should by no means recommend those crops of oats, without any manure but lime, which are so frequently taken in Scotland. The first crop seldom gives more than the seed; a green crop is certainly far preferable upon Bog at the commencement, and at all events, a dressing of ashes may be given for the first crop, as it will give a good return, and compensate for the outlay.

Perhaps it may be as well to sow grass seeds at once, after fallowing and liming, which will soon bring it into good sheep pasture, and after some time, it may bear heavy cattle.

The Expense and Return of this system, may be as follows;

	£.	*s.*	*d.*
1st Year, drainage per acre - - - - - -	—	10	—
3d - - ploughing - - - - - - -	1	—	—
5th - - three ploughings and harrowings - -	3	—	—
40 Barrels Lime, - - at 2 *s.* 6 *d.* - -	5	—	—
6th - - Oats seeds and labour - - - -	4	10	—
7th - - Ditto, with grass seeds - ditto - - -	7	—	—
	£. 21	—	—

Return of First Rotation:

	£.	s.	*d.*
6th Year, 10 barrels Oats, at 14 *s.* - - - -	7	—	—
7th - - 12 barrels - ditto - - - - -	8	8	—
8th,—9th Two years Hay - - - - - -	6	—	—
10th,—11th Two years pasture - - - - -	2	—	—
£.	23	8	—

Profit on First Rotation - - £. 1. 12 *s.*

2d Rotation:

	£.	*s.*	*d.*
12th Year, Oats on the lea, seed, and labour - -	4	10	—
13th - - Turnips or potatoes, with manure - -	10	—	—
14th - - Oats, with seeds - - - - -	7	—	—
	£. 21	10	—

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Returns,	£.	s.	d.
12 barrels of Oats	8	8	—
70 ditto - - Potatoes	17	10	—
12 ditto - - Oats	8	8	—
5 Years Hay and Pasture	10	—	—
£.	44	6	—

Profit of 2d Rotation - - £. 22. 16*s.*

The Bog should now be limed on the sward, if this was not done ere beginning the second Rotation.

The REPORT of Mr. *Richard Griffith*, junior, on the Bog Improvements at Chat Moss, in Lancashire;—With Two Engravings, viz.

Pl. XVII.—Section of the Edge of Chat-Moss, near Burton;
Mr. Roscoe's Process of cutting Bog Drains;—and,
Side View of Mr. Roscoe's Bog Plough.

Pl. XVIII.—Perspective View of Mr. Roscoe's Horse Patten;—
Side View of the Horse Patten; and,
Plan of the Patten with the Straps open to receive the Hoop.

Report on the Bog Improvements at Chat-Moss, in Lancashire:—By *Richard Griffith*, junior, C.E. F.R.S. Edinburgh; Honorary Member of the Geological Society of London.—1812.

To the Commissioners appointed to enquire and examine into the Nature and Extent of the several Bogs in Ireland, and the Practicability of Draining and Cultivating them, and the best Means of effecting the same.

Gentlemen,

IN the month of January last, I proceeded, according to your directions, to view the extensive Bog Improvements at *Chat-Moss*, in Lancashire.

I have now the honour of submitting to your consideration, a Report on the present state of those Improvements, together with some account of the peculiar implements of husbandry which are in use at that place.

Previous to the publication of the Reports of the Commissioners for the Improvement of Bogs in Ireland, it had been imagined, by many English gentlemen, that the Bogs of Ireland were similarly circumstanced to the Fens in *Lincolnshire*. These erroneous ideas are now, no doubt, in a great measure, removed by your First Report to Parliament, wherein the distinguishing features of the Fens and Bogs have been clearly pourtrayed; it may not however be unimportant to state, that the Mosses of *Lancashire* are exactly similar, in situation and composition, to the Bogs of Ireland, and consequently that any Bog or Moss Improvements that have been accomplished in Great Britain, may also, with equal facility, be carried into effect in this country.

The county of *Lancaster* contains no less than 26,500 acres of Moss Land, the greater part of which is at present in a wild and unproductive state. No improvement worthy of consideration had been attempted till the year 1793, when Mr. Roscoe, of Allerton Hall, near Liverpool, and Mr. Wakefield, commenced the improvement of Trafford Moss. This Moss is small and not very deep; it is situated about four miles from Manchester, between the Duke of Bridgewater's Canal and the river Irwell. The reclamation of this Moss has been completed for some years, and is now fully equal in value to any land in the country; it has been let for five pounds per English acre; the lease is now expired, and Mr. Roscoe was offered, by a respectable tenant, six pounds per English acre for it, which is equal to £. 10. 10*s.* 7 *d.* Irish money per Irish acre, provided he should agree to cover the surface with a thin coat of Marl. Mr. Roscoe has refused this offer, deeming it more advantageous to retain this improved Bog in his own hands, as a change for his sheep from his great Bog improvement at Chat-Moss.

Chat-Moss is by much the most extensive lowland Bog in England, it contains 7,000 English acres; it is in every respect similarly circumstanced with our Irish Bogs, in regard to the adjoining country, being bounded on all sides by ridges of ground or rolled stones mixed with clay, which prevent the immediate discharge of its waters into the nearest river. This is particularly exemplified by the ridge of gravelly soil, which prevents the waters from the south-east side of this Moss from immediately discharging themselves into the river Irwell. It is probable that this bar of gravel, by interrupting the course of the waters, originally caused the growth of Chat-moss. Like most of our Irish Bogs, this moss presents at its edges nearly an upright face; the spongy surface of the moss being elevated at a very short distance from the edge from ten to twenty feet above the level of the immediately adjoining land.

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lend. The annexed Plate, No. 1, Fig. 1, represents a section or profile of the edge of the Bog near Barton. The moss in this part is very porous for the upper ten feet, from whence to the bottom, it becomes gradually more compact. The immediate substratum to the Bog is a bed of siliceous sand, which varies from one to five feet in thickness, below which is a bed of bluish and sometimes reddish clay marl of excellent quality.

The marl varies in thickness very considerably; in some parts it is not more than three feet, in others its depth has not been ascertained; below the marl is a bed of sand-stone gravel of unknown thickness; it is this bed of gravel which extends beyond the edge of the Bog, and by forming an undulation in the ground, prevents the direct discharge of the waters from the flat country to the north into the river Irwell.

The depth of Chat-Moss varies from fifteen to thirty (and, as I am informed to forty) feet; its surface is extremely wet, and from its general appearance, I may venture to assert, it presents as uninviting a prospect to a Bog reclaimer, as any to be met with in Ireland.

Mr. Roscoe commenced his operations by cutting drains through 1,500 acres of the moss; his mode of proceeding was simple. The dimensions of the first drains he made, were one foot cube, and were cut parallel to each other, at the distance of fifty yards from one side of the Bog to the other; the expense of cutting these Drains was 1 ½ *d.* for eight yards lineal. After the Bog had consolidated on the edges of these drains, their dimensions were increased three feet top, one foot bottom, and three feet deep; this second operation cost seventeenpence for eight yards. And lastly, when the sides of the drains had again become sufficiently solid, their dimensions were increased to four feet top, one foot bottom, and four feet deep. (*See* Fig. 2, Plate 1.) The expense of the last operation was fourpence for eight yards; making the total expense of the drain, when finished, to be twelvepence halfpenny for eight yards, or a little more than three halfpence per yard, which is equal to 12 *s.* 6 *d.* per English acre, or £. 1. 0 *s.* 3 *d.* nearly per Irish acre.

The foregoing system of drains appear to have succeeded as far as Mr. Roscoe has proceeded in tilling the Bog, as the drains in tillage grounds are necessarily cleaned each year, and the ridges being made at right angles to the drains, the actual surface of the Bog is rendered tolerably firm; but I am persuaded the above-mentioned system of drains would be found insufficient, were the Bog laid down in grass, as well as on account of their trifling depth, as from the want of cross or intercepting drains. According to Mr. Roscoe's present plan, should any interruption to the current of the water take place in any of the drains, by the slipping of the side, or other casualty, the whole of the water in the upper part of the drain would be pent up, and consequently flood the Bog on either side. Such accidents would be interrupted if cross-drains were made, as the water, being interrupted in its usual course would naturally flow through the next cross-drain to the nearest discharging drain. I am of opinion, that the Bog would be much benefited if every second or alternate discharging drain were deepened to five, or perhaps six feet; and if cross-drains were made at right angles, to the discharging drains, at the distance of 300 yards from each other; their dimensions should be five feet top, one foot bottom, and four feet deep.—(*See* Plate No. 1, Fig. 3.)

In examining those parts of Chat-Moss, through which drains have been cut, I observed that although the surface of the Bog was very wet (which might partly be attributed to a very rainy season, and partly to imperfect draining) it was much more solid than those parts where no drains had been made; and that the Bog Moss had ceased to vegetate, though I found it growing very luxuriantly in the undrained part.

Of the 1,500 acres of Bog through which Mr. Roscoe has cut drains, no more than 200 have as yet been brought into cultivation. On this portion many experiments have been made, with various success. I shall give an account of some of them.

1st Experiment:

Sixty English acres of the Bog were marled with 150 tons per acre; the marl was drawn on the Bog in small carts, having three broad wheels, two behind and one before. The marl being spread, the Bog was ploughed with a plough of a very peculiar construction, and the horses (two in number) worked abreast, and wore large wooden pattens on their feet, (*see* description of the Plough and Patten). By the assistance of these Pattens, Mr. Roscoe has been enabled to plough with horses, where the Bog was so soft, that men found it difficult to walk without sinking.

The Bog fields were ploughed at right angles to the drains: By these means, the furrow of each ridge acted as a surface-drain for the ridge, and delivered the water into the discharging drains on either side.

Early in the month of October, after the first ploughing, wheat was sown in the sixty acres, partly broad-cast, and partly in drills; the quantity of seed was two bushels of sixty pounds each for the broad cast, and half that quantity for the drills, per statute acre. The produce of the sixty acres amounted, on an average, to seventeen bushels, each weighing sixty pounds, per acre. This may be considered as a very light crop, when compared with the usual produce of wheat on upland; but it should not be forgotten, that the crop was raised from wet red bog, after one ploughing.

The wheat grown on the bog was of very fine quality; the grain was large, full, and of good colour, and was sold at the next market town, at the rate of *£.* 2. 16 *s.* for four measures of

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of 70 pounds, which is equal to 20 stone of 14 pounds; and the highest price given for wheat at the time was £.2. 17*s.* for the same quantity. I have brought a sample of the wheat over with me, and I shall leave it at the Dublin Society House for inspection.

Second Experiment:

Forty acres of bog were ploughed and sown with wheat in the month of March, in drills, and rape dust was laid on the bog with the seed, by an ingenious addition to the drilling machine. The crop was bad, which may be attributed partly to the time of sowing, and partly to deficiency of manure; besides rape dust is not a manure suited to a wet boggy soil. Something solid is required to compress the spongy texture of the moss; and perhaps calcareous clay marl has more immediate effect in compressing and decomposing a peat soil, than any other substance to be procured at a cheap rate.

Third Experiment:

One hundred acres of red bog were ploughed and burned; turnip seed was afterwards sown in drills, and marl was laid on the drills at the same time, by the addition to the drilling machine already mentioned. This crop failed entirely, which was owing no doubt to the surface of the bog being too wet (for turnips do not succeed in wet ground) and to the very scanty portion of marl. The ashes from the burnt bog were white; and white peat ashes are composed of from 30 to 40 per cent. of sulphate of lime, and the remainder of siliceous and alluminous earths.

From experience in other places, Mr. Roscoe is of opinion that turnips cannot be expected to succeed on bog that has not been well drained, and has gone through a course of at least two crops. It is also necessary that the bog should be well marled and manured with dung. Red Bog treated in this manner, and sown with turnip seed, will not fail to produce an excellent crop. Mr. Roscoe thinks that common turnip is better than Swedish turnip for bog. He thinks also, that sheep should be folded on the turnip field. This mode of proceeding will have two excellent effects on the bog; first, the additional manure of the sheep's dung; and secondly, the treading the surface of the bog, and rendering its spongy texture more solid. Sheep do not become lame by treading on bog; it is probable that the astringent quality of bog-water may be useful to their feet.

Oats have been cultivated on Chat-moss, but did not succeed well; the crop ran too much to straw, and the grain did not fill.

Wheat has been sown on forty acres of Chat-moss this year, which has been marled at the rate of 150 tons per statute acre. The crop, when I saw it (in the month of January) looked extremely well and healthy, and I have no doubt there will be an excellent return.

Mr. Roscoe is forming a cast-iron railway from his marl pit to the interior of the bog; by this means he will be enabled to manure a great part of what has been drained this year; and I have no doubt, from the skill and ingenuity with which every thing is conducted by him, that his patriotic endeavours will be crowned with success. I say patriotic, for doubtless any man who gives up a great portion of his time and fortune to the reclamation of land, which has hitherto been deemed perfectly steril, merits that character, as well on account of the great extent of fruitful land, which (I might almost say) he has created, as from the very useful lesson he teaches other men who may be similarly circumstanced, and who have hitherto been afraid to venture on the improvement of a great bog.

Plough made use of by Mr. Roscoe at Chat-Moss:

The construction of this plough is different from most others; its chief peculiarity consists in the coulter, which is placed within one foot of the end of the beam. Its form may be seen by reference to Plate No. 1, fig. 4. From A to B, a length of one foot six inches; it is nearly perpendicular to the beam; at which point it is within six inches of the level of the sole of the Plough; from whence it forms a curve convex at the outside, till it nearly meets the point at the sock. The outer edge of the coulter is kept extremely sharp, so as to cut the surface of the bog; the sock, which is of the kind called the spear-sock, is one foot six inches in length, and is extremely sharp on both edges. Two wrought-iron plates, each four inches in breadth, are welded to the large or inner edge of the sock, and are so placed as to form a regular increase of width from the point of the sock to the heel of the Plough; the entire length is four feet, and the distance between the outside edges of the plates at the heel is fifteen inches; these Plates project both on the mould board, and straight sides of the Plough, one inch beyond the outward edges. These projections are shewn in Plate No. 1, fig. No. 5; which figure is a representation of the sole of the Plough turned upside down; the dotted lines point out the above-mentioned projections or wings.

The peculiar fitness of this Plough to boggy soil, consists, first, in the sharpness of the coulter, which makes an incision six inches deep into the bog, and also from its peculiar form, will raise the Plough over any obstacle it may meet. And secondly, the projecting wings, by cutting an inch into the sod on either side of the furrow, form a perfect separation of the sod turned up from the adjoining boggy soil. This is an object of considerable importance, and should always be attended to; for if the boggy fibres contained in the sod turned up, be not completely separated from the adjoining bog, it will be found that the uncut fibres will act as water-conductors from the neighbouring bog to the sod turned up;

(5.)
EXTRACTS
from the Appendixes to preceding Reports.

Rep. IV.
Mr. Griffith, junior.

and the natural consequence, where the connexion is not thus completely broken off, must be, that the ploughed surface of the bog will remain wet for a considerable time; but in those places where the separation from the adjoining bog is complete, the ploughed surface of the bog will become dry almost immediately.

Description of the Horse Patten:

The base of the Patten is formed of a deal board twelve inches long, eleven inches broad, and one inch thick; on each side of this board two plates of wrought iron A B and C D, three inches broad, and the twentieth part of an inch in thickness, are fastened down by rivets, which pass from the upper, through the board, to the lower plates. The distance between the plates A B and C D is two inches; the staples E and F are passed through the plate A B, and are rivetted in the lower plate. These staples are placed four inches asunder, and also four inches distant from each end of the plate A and B. Through the staples E and F, two links Q and R are passed, each three inches and a half long; G and H are iron fasteners, having an eye at one end and screw-hole at the other; K an iron heel-piece, having an eye at either end: it is fastened down to the centre of the plate C D by a bolt L, which is rivetted on the under side. M N and O P are iron straps, which pass through the links Q and R, and connect the heel-piece K with the fasteners G and H; the straps are made of hoop-iron, bent into the form represented in fig. No. 1; the ends are fastened together by the rivet S; T a screw, which, when the horse's hoof is placed between the straps, is passed through the screw-holes in the fasteners, and when screwed home, prevents the hoof from moving at the front part of the Patten. U V is a horse-shoe, in the construction of which there is nothing particular, excepting the projections W and X; when the horse's hoof is contained in the Patten, the heel is fastened down by these projections, which pass under and in contact with the straps M and N and O P close to the heel-piece. Fig. No. 1, Plate 2, is a perspective view of the Patten and Shoe, in which the hoof has been omitted, to give an inside view of the straps and fasteners. Fig. 2 is a side view of the Patten, with the horse's hoof fastened in. Fig. 3 is a plan of the Patten, with the straps open to receive the hoof.

The weight of the Patten above described is nine pounds; it is certainly much heavier than is requisite. I think the wooden board which forms the base might be much thinner, and the iron plates might also be made lighter and less broad.

It is probable, that if a base were made of a single sheet of wrought iron, of a tenth of an inch in thickness, or perhaps of the eighth part of an inch, with a thin iron frame round the edges to prevent its bending, it would answer the purpose equally well, and be much lighter than Mr. Roscoe's Patten.

I do not think that Mr. Roscoe's mode of fastening the horse's foot into the Patten can be much improved; besides, its being simple, and not liable to get out of order, is a recommendation that should not be over-looked. To those who have not seen horses ploughing with Pattens of the dimensions above described, it may appear almost incredible that they should move freely, and without injuring their legs; but it is nevertheless true, that by practice the horses used by Mr. Roscoe in ploughing on Chat-Moss, have not only become accustomed to walk with their legs sufficiently apart, so as that the Pattens may not strike each other, but that they proceed, when the bog is not very wet, at a pace fully equal to that of horses ploughing on clay lands. When the bog is tolerably dry, the quantity which is usually ploughed at Chat-Moss, by a pair of horses, is one statute or English acre per day; but where any obstacles occur, or where the bog is particularly wet, a pair of horses will not get through more than half that quantity.

I have brought over with me (as a model) a Horse Patten that has been much used; I shall leave it at the Dublin Society House, that gentlemen may have an opportunity of seeing it.

Some trials have been made in Ireland to put Pattens on bullocks instead of horses, for ploughing on bog. The Dean of Kildare made some improvements with bullocks, at Bellegrove, in the Queen's County, but he has not yet brought them to perfection; the base of the Patten which he used was entirely of wood, and was fastened on the foot by leather straps.

It is to be expected that bullocks should succeed in ploughing on bog better than horses, as they will submit to accidents, and overcome obstacles with more temper.

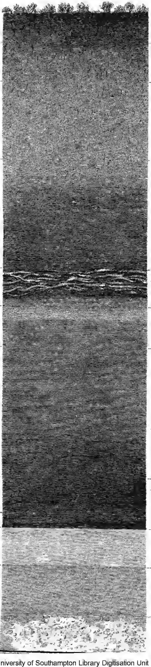
I have the honour to be, Gentlemen,
Your most obedient humble Servant,

Dublin, March 1812.

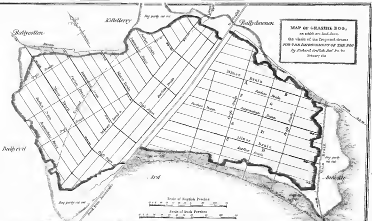
Richard Griffith, junior.

SECTION OF A TURF BANK IN TIMAHOE BOG.

In which the several variations in the compositon between the top & the bottom are pointed out.



	Nº	Depth in feet	
	1	2	*Dark reddish Brown, maſs compact, no fibres of Moſs visible, surface of Bog decomposed by the Atmosphere*
	2	3	*Light reddish Brown, fibres of Moſs very perfect*
	3	5	*Pale yellowish Brown, fibres of Moſs very perceptible*
	4	8½	*Deep reddish Brown, fibres of Moſs perceptible*
	5	3	*Blackish Brown fibres of Moſs scarcely perceptible, contains numerous twigs, & small branches of Birch, Alder & Fir*
	6	3	*Dull yellowish Brown, fibres not visible contains much empyreumatic Oil, maſs compact*
	7	10	*Blackish Brown, maſs compact fibres not visible contains much empyreumatic Oil*
	8	4	*Black maſs very compact, has a strong resemblance to Pitch or Coal fracture conchoidal in every direction and lustre shining*
Depth of Bog		38½	
	9	3	*Marl, contains 64 pʳ cᵗ of carbonate of Lime*
	10	4	*Blue Clay*
	11	*Depth Unknown*	*Clay mixed with Limestone gravel*



MAP OF GRASHIL BOG,
on which are laid down
the whole of the Proposed drains
FOR THE IMPROVEMENT OF THE BOG
By Richard Griffith Jun^r. Esq. &c.
February 1810

Ordered by the HOUSE OF COMMONS to be printed, 11th April 1810
and to be reprinted 7th June 1810

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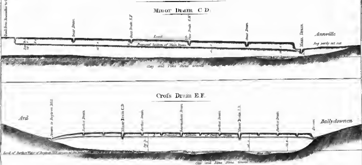
Plate IV. Appendix No 4.—Second Report from the Commissioners on the Bogs of Ireland, 1811

SECTIONS IN GEASHIL BOG.



Minor Drain C D.

Cross Drain E.F.

Scale of Length 320 Feet or 20 Perches Irish to an Inch.
Scale of Height 30 Feet to an Inch.

Ordered by The House of Commons to be printed 1st April 1811.
And to be reprinted 7th June 1813.

96
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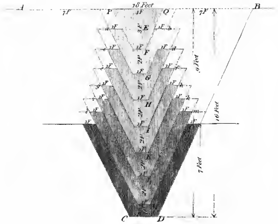
PLAN FOR EXECUTING DRAINS IN BOGS



The Section A B C D Contains in One Perch		124	*Cubic Yards*
The first Cutting E Contains in d°.	5½		
2d ... d° ... F ... d°	5½		
3d ... d° ... G ... d°	6¾		
4th ... d° ... H ... d°	7		
5th ... d° ... I ... d°	8		
6th ... d° ... K ... d°	10		
7th ... d° ... L ... d°	11¾		
8th ... d° ... M ... d°	12	66	
	difference	58	

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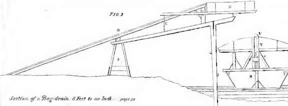
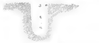
Ordered by the House of Commons to be Printed ... April 18

FIG. 1

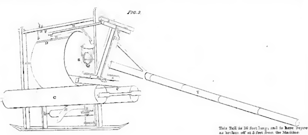


Section of a Bog-drain. 6 Feet to an Inch. *page 52*



MACHINE FOR LOADING & UNLOADING BOATS WITH EARTH. *(page 181)*

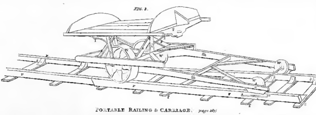
FIG. 2.



This Tail is 16 feet long; and is here represented as broken off at 5 feet from the Machine.

MACHINE FOR SOUNDING RIVERS. *(page 186)*

FIG. 3.



PORTABLE RAILING & CARRIAGE. *(page 187)*

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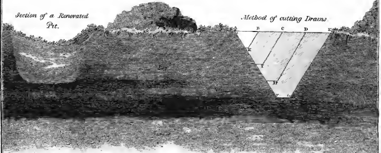
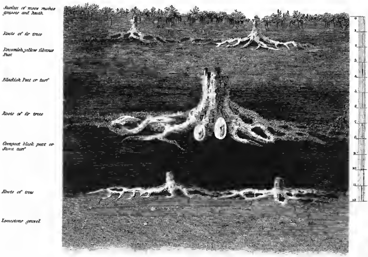

Section of a Renovated Pit.

Method of cutting Drains

Section of a Turf Bank exhibiting three distinct growths of trees.

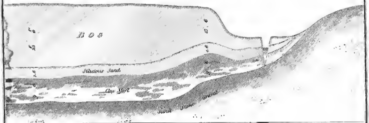


…n by H. Clements

James Basire sculp

Section of the Edge of Chat-Moss near Barton.

Fig. 1.



Plan of Mr. Roscoes System of Drains.
with the addition of Cross Drains.

Mr. Roscoe's Process of Cutting Bog Drains

Fig 2

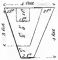
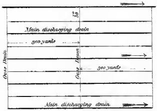
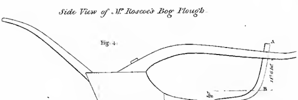


Fig 3



Side View of Mr. Roscoe's Bog Plough

Fig 4



Plan of the Sole of the Plough turned up

Fig 5

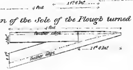


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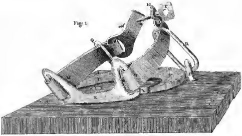
PLATE. No 2

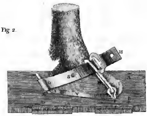
Perspective View of Mr Roscoe's Horse Patten.

Fig. 1



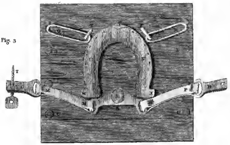
Side View of the Horse Patten.

Fig. 2



Plan of the Patten with the Straps open to receive the Hoof.

Fig. 3



Scale ¾ of an Inch to a Foot.

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